Teacher and Student Experiences of Remote Microphone Systems

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Abstract

Aims: This study was conducted to identify and analyse the experiences and needs of teachers and students using a remote microphone (RM) system, in schools within the Canterbury region of New Zealand.

Methods: Semi-structured interviews were conducted with seven teachers and eight primary school students. These were then transcribed and analysed to identify common themes.

Results: This thesis found that teachers and students saw the RM as an extremely useful piece of technology that they were able to easily use on a daily basis to facilitate communication in the classroom. The challenges reported did not detract from an overall positive perception of the technology. Successful use was underpinned by the attitudes and efforts of the teacher, the student, and a surrounding network of support persons. Most, but not all teachers reported being happy with the amount of support they received to use the RM system.

Conclusions: There is still a need for reliable and easily found online information for teachers that will support them to self-educate about optimal RM use, and seek out professional help as needed. The Van Asch Deaf Education Centre online modules currently in development are one possible resource for this purpose. Audiologists can support the successful use of RM systems through appropriate verification procedures, and helping to develop advocacy skills in both children with hearing loss and their parents.

Keywords: Remote microphone systems, RM systems, classroom, students, deaf or hard of hearing

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List of Abbreviations

AAA – American Academy of Audiology

ANSD – Auditory Neuropathy Spectrum Disorder

ASHA – American Speech-Language-Hearing Association

AoDC – Adviser on Deaf Children

ADHD – Attention Deficit Hyperactivity Disorder

APD – Auditory Processing Disorder

ASD – Autism Spectrum Disorder

dB – Decibel

ENT – Ear Nose and Throat doctor, or otolaryngologist

FM – Frequency Modulation

HAT – Hearing Assistive Technology

ILE – Innovative Learning Environment

MoE – Ministry of Education - Te Tāhuhu o Te Mātauranga

MoH – Ministry of Health - Manatū Hauora

OME – Otitis Media with Effusion

RM – Remote Microphone

RT_{60} – Reverberation Time

RTD – Resource Teacher of the Deaf

SCIP – Southern Cochlear Implant Programme

SNR – Signal-to-Noise Ratio

UNHSEIP – Universal Newborn Hearing Screening and Early Intervention Program

VADEC – Van Asch Deaf Education Centre

WHO – World Health Organization

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Introduction

Hearing loss can affect an individual at any age or stage of their life, from newborn babies through to the elderly. Hearing difficulties are particularly impactful in a child's early years when auditory input is crucial for developing language, communication and social skills (Antia, Jones, Luckner, Kreimeyer, & Reed, 2011; Yoshinaga-Itano, Sedey, Wiggin, & Chung, 2017). In turn, hearing loss is also a significant risk factor for disrupting children's learning and development of academic skills (Ching, Dillon, Leigh, & Cupples, 2018; Khairi Md Daud, Noor, Rahman, Sidek, & Mohamad, 2009).

To gain an understanding of the reasons a child may have hearing difficulties, this thesis will firstly review the different types of hearing loss in children and what actions may be taken to help them hear better. The implications of hearing loss at school, factors that affect classroom listening and strategies that may be used by a teacher will be discussed. The author will then focus on a key strategy – the use of remote microphone (RM) systems, designed to improve the audibility of the classroom teacher's voice.

Hearing Loss in Children

Types of hearing loss. Hearing impairment can be categorised as being of conductive, sensory or neural origin, any of which may affect a child. Each of these types is summarised below.

Conductive hearing loss. Hearing loss involving the physical disruption of sound being transferred through the outer and middle ear structures to the inner ear is known as conductive (Møller, 2013). The middle ear acts as an impedance transformer, reducing the transmission loss that would otherwise be expected for sound passing from the low-impedance air to the higher impedance cochlear fluids (Pickles, 2012). Pathologies that affect the mass of the outer and middle ear will typically reduce sensitivity to higher frequency sounds, while ones that affect the stiffness will reduce sensitivity to lower frequencies

(Madell & Flexer, 2014). Conductive loss may result in the attenuation of sound by up to 60 dB, and this may be either temporary or permanent (Feldman, 1963).

There are a variety of causes of conductive hearing loss. Otitis Media (OM), the inflammation of the mucous membrane of the middle ear, is one of the most common infectious diseases affecting children worldwide, and may be acute or chronic (Berman, Johnson, Chan, & Kelley, 2001; Kline, 1999). In many cases, non-infected fluid can accumulate in the middle ear space, leading to a conductive loss (Ashik Ahamed & Krishnamoorthy, 2016). This is known as Otitis Media with Effusion (OME).

Blockage of the ear canal, and subsequent conductive loss, may occur due to accumulated cerumen, otitis externa, congenital malformation, the presence of a foreign body or growths such as exostoses (Barbon, Hegde, Li, Abdelbaki, & Bajaj, 2017; Bressler, Bressler, Shelton, & Shelton, 1993; Møller, 2013). Movement of the tympanic membrane may be impeded by perforation or tympanosclerosis (Asiri, Hasham, Anazy, Zakzouk, & Banjar, 1999; Park et al., 2015). The role of the eustachian tube (a canal connecting the middle ear space with the nasopharynx) is to equalise the air pressure inside the middle ear space in relation to ambient air pressure (Møller, 2013). Disruption of this process may lead to a change in middle ear pressure that leads to conductive loss. Interruption of the ossicular chain (via for example discontinuity or immobilisation) leads to inefficient sound transfer from the tympanic membrane to the cochlea and is a cause of conductive hearing loss (Møller, 2013).

Sensory hearing loss. Disruption to the process of converting cochlear fluid vibration into nerve signals in the inner ear is known as sensory hearing loss (Madell & Flexer, 2014). This type of hearing loss is commonly due to damage to the outer hair cells of the organ of Corti. These outer hair cells are responsible for the sensitivity and fine tuning of the cochlea (Madell & Flexer, 2014). In older people sensory hearing loss may be a natural consequence

of the aging process (presbycusis) or the effect of accumulated noise exposure over time (Pickles, 2012). For children (and some adults) this type of loss can also be caused by infection, ototoxic chemicals, injury, or may be genetic (Pickles, 2012). In other cases, sensory loss may be due to other types of inner ear damage, e.g. inner hair cells, especially when hearing thresholds are greater than 60 dB HL. Inner hair cells are responsible for transducing the motion of the basilar membrane (Møller, 2013). They may be damaged as a result of infection, or may present in reduced numbers in, for example, Pendred Syndrome (Everett et al., 2001). Damage to other aspects of the inner ear may also lead to sensory loss e.g. supporting cells, stria vascularis and or spiral ligament (Du, Wu, & Li, 2006).

According to the World Health Organization (WHO) (2016), nearly 40% of childhood hearing loss can be attributed to a genetic cause. Genetic sensory hearing loss may be associated with a syndrome (e.g. Alport Syndrome, Branchio-Oto-Renal syndrome etc.) or may be nonsyndromic (Madell & Flexer, 2014). Sensory hearing loss is usually permanent, although in some cases it can be fluctuating or progressive, for example when caused by cytomegalovirus (CMV) or enlarged vestibular aqueduct syndrome (EVAS) (Fowler et al., 1997; Madell & Flexer, 2014; Mori, Westerberg, Atashband, & Kozak, 2008).

Neural hearing loss. Neural hearing loss exists when there is disruption of the hearing pathway anywhere from the vestibulocochlear nerve up to the auditory cortices (Reynolds, Richburg, Klein, & Parfitt, 2014). Auditory neuropathy spectrum disorder (ANSD) is one example of this type of hearing loss, also described as auditory dys-synchrony due to the lack of synchronous nerve firing (Madell & Flexer, 2014). Diagnostic indicators include an abnormal or absent Auditory Brainstem Response (ABR), poor speech perception, lack of acoustic reflexes, and present otoacoustic emissions (OAEs). Hearing sensitivity in ANSD clients varies from normal to profound, most often in a flat or reverse-sloped configuration, and may be either fluctuating or progressive. Auditory neuropathy may also

have a sensory origin, where there is a failure of the cochlear (most likely the inner hair cells) to transmit signals to the auditory nerve. Other causes of neural hearing losses include neoplasms, hydrocephalus, hypoxia and hyperbilirubinemia (Madell & Flexer, 2014).

Sensory and neural hearing losses are commonly grouped together under the term 'sensorineural', meaning a hearing loss that is caused by a lesion anywhere from the cochlea to the auditory cortices. It is important to note that an individual may have hearing loss due to more than one site of lesion (i.e., both conductive and sensorineural components). This is known as a mixed hearing loss.

***Auditory processing disorder*.** Auditory Processing Disorder (APD) is also known as Central Auditory Processing Disorder (CAPD). Separate from the above categories of hearing loss, those affected have normal peripheral hearing yet still have difficulties identifying or discriminating sounds (Reynolds, Kuhaneck, & Pfeiffer, 2015). It is often identified in children of primary school age who complain of difficulty understanding speech in background noise (Dawes & Bishop, 2009).

Prevalence of childhood hearing loss. According to Mehl and Thompson (1998), the rate of bilateral congenital hearing loss requiring amplification is around two per 1000 babies. Bess, Dodd-Murphy and Parker (1998) estimated the prevalence of mild hearing loss (sensorineural, conductive or mixed) in a general school population to be 11.3%. According to the WHO, globally there are estimated to be 32 million children with hearing loss of at least mild or greater severity, in their better hearing ear (WHO, 2013). No official data is available on the number of New Zealand children with hearing loss.

Identifying childhood hearing loss. Early identification of childhood hearing loss can minimise developmental delays, and facilitate communication, education and social development (WHO, 2016). In New Zealand, The Universal Newborn Hearing Screening and Early Intervention Program (UNHSEIP) exists to identify children with permanent congenital

hearing loss soon after birth (Ministry of Health - Manatū Hauora [MoH], 2016). Practices are aligned with the recommendation of the Joint Committee on Infant Hearing that initial hearing screening be completed by one month, diagnostic testing be completed by three months, and that early intervention should begin by six months of age (Joint Committee on Infant Hearing, 2007).

A child's hearing difficulties may be identified later, firstly if there are any parental concerns about the way they are responding to sound. In addition, if speech and language difficulties are noticed, then investigation will include audiological assessment to establish whether hearing loss is the underlying cause. The 'B4 school' vision and hearing tests which are administered at four years of age as part of the Well Child checks may also identify children with hearing loss (Kids Health, 2016).

Management of childhood hearing loss. The WHO (2016) estimates that approximately 60% of childhood hearing loss could be avoided with appropriate preventative measures. Interdisciplinary management of hearing loss is necessary for optimal outcomes, and the professionals involved will depend on the needs of the child. The section below describes some of the steps that may be taken, and further strategies that are applicable for the classroom environment are discussed later.

Medical intervention. For children identified with OME, 50% of cases will resolve spontaneously within three months (American Academy of Family Physicians, 2004). Medical management may be recommended when problems are ongoing beyond this time, or reoccurring (Yousaf, Inayatullah, & Khan, 2012). Typically, after referral to an ear nose and throat (ENT) specialist a child would undergo a simple surgical procedure for the insertion of ventilation tubes or an adenoidectomy (Yousaf et al., 2012). Acute otitis media may be managed with watchful waiting or the use of antibiotics, depending on the severity of infection and age of the child (Bascelli & Losh, 2001).

In the case of severe to profound sensorineural hearing impairment, cochlear implant surgery may be an option. The child's candidacy will be carefully assessed and the parent or caregiver(s) supported in making this difficult decision (Reynolds et al., 2014). The team of professionals involved typically includes an audiologist, general physician (GP) and ENT, Speech and Language Pathologist (SLP), psychologist and other hearing support workers (Reynolds et al., 2014). Surgery involves the insertion of an electrode array into the scala tympani of the child's cochlea (Reynolds et al., 2014). Other implanted parts include a receiving coil/internal processor (placed in the mastoid bone), a magnet, an electronics package and extracochlear electrodes (Zwolan, 2015). External components include a microphone, speech processor, control switches, connecting cables, and a transmitter (Reynolds et al., 2014; Zwolan, 2015). Sound is picked up by the microphone on the sound processor and converted into digital information, which is then transferred through the coil to the implant under the skin. The implant then sends this electrical information down the implanted electrode in the cochlea, stimulating the hearing nerve fibres and allowing nerve impulses to be sent to the brain (Zwolan, 2015).

Hearing aids. Air conduction aids are commonly worn by hearing impaired children. A microphone picks up environmental sound, amplifies and processes it, and delivers it to the listener through a receiver (speaker) which is coupled to the ear most commonly in children by an earmold (Mueller, Ricketts, & Bentler, 2014). In cases of conductive hearing loss (e.g. due to recurrent OME problems) a bone conduction hearing aid may be recommended. In this case, instead of the receiver, sound is transferred with the use of a vibrating oscillator via bone conduction to the cochlea (Mueller et al., 2014). As stated above, whatever hearing aid is chosen, rehabilitation for permanent congenital loss should begin no later than six months of age. The use of hearing aids combined with early timing of the intervention has significantly positive implications for children's speech and language development

(Yoshinaga-Itano, 2000). Hearing aid output is adjusted by the audiologist to meet amplification targets that maximise speech audibility according to a prescription (Gabbard, 2004). Features useful for children's hearing aids include a tamper-proof battery door, high dust and water resistance ratings, and bright colour options to make it appealing etc. as seen with the Phonak Sky™ (Phonak, 2018).

Future compatibility with other technology such as an RM system for school (as discussed later in this thesis) is another important consideration when choosing the model (Gabbard, 2004). Frequent follow up appointments are needed to monitor the child's hearing, speech and language development, to provide new earmolds as the child grows, and to engage the family in ongoing counselling.

Impact of Childhood Hearing Loss

While hearing difficulties primarily affect a student's ability to hear conversational speech, this has the consequence of impacting their communication development as a whole, dramatically altering their acquisition of social and academic skills (Brackett, 1997). The extent of this effect is influenced by a number of factors, including age of onset, the severity of the child's hearing loss, whether it is permanent or fluctuating, and interventions used such as technology or communication strategies (Brackett, 1997; WHO, 2016). Students with severe or profound hearing loss are of course most noticeably impacted, but the effects for those with less severe losses (such as mild to moderate hearing loss, unilateral loss, or conductive loss, even if temporary) remain significant and worthy of attention (Brackett, 1997). Various aspects of a child's learning that are affected by hearing loss are discussed below.

Speech and language. Finitzo-Hieber and Tillman (1978) measured speech recognition in noise and reported that children with mild to moderate hearing loss had a 20 to 30% decrease in speech understanding when compared to normal hearing peers. The ability

to hear and understand speech is crucial at school for understanding teacher instructions and interacting with peers.

The speech of a child with hearing loss can sometimes be difficult to understand. According to the American Speech-Language-Hearing Association (ASHA) (2015), a child with hearing loss may not hear their own speaking and therefore be unaware of the volume and pitch of their voice. High frequency speech sounds such as ““s,” “sh,” “f,” “t,” and “k”” are often not heard by children with hearing loss, meaning they then do not include them in their own speech (ASHA, 2015, p. 1). Missing word endings such as *-s* or *-ed* may lead to misunderstandings and misuse of verb tenses, pluralization, possessives and nonagreement of subjects and verbs (ASHA, 2015).

In a review of past and present research regarding language and literacy development in children with mild to severe hearing impairment, the effect of hearing loss on children’s vocabulary development was inconclusive (Moeller, Tomblin, Yoshinaga-Itano, Connor, & Jerger, 2007). Some studies found that even the mildest degree of hearing loss delayed vocabulary development (Davis, Elfenbein, Schum, & Bentler, 1986; Davis, Shepard, Stelmachowicz, & Gorga, 1981; Wake, Hughes, Poulakis, Collins, & Rickards, 2004). Two research studies into early receptive and expressive vocabulary in young children with hearing loss found significant delays compared with age-matched normal hearing peers (Mayne, Yoshinaga-Itano, & Sedey, 1999; Mayne, Yoshinaga-Itano, Sedey, & Carey, 1998). This is contrary to other studies where children with mild to moderate hearing loss achieved comparably to age-matched peers with normal hearing (Gilbertson & Kamhi, 1995; Plapinger & Sikora, 1995; Wolgemuth, Kamhi, & Lee, 1998). The authors speculated that background variables (such as age of hearing intervention) may have influenced results for low performers, and recommended further prospective research into understanding the sources and nature of vocabulary delays (Moeller, Tomblin, et al., 2007). There is suggestion that

phonetic and phonological delays may be a contributing factor to vocabulary development, and that future research should focus on examining the perceptual and cognitive processes underlying symbolic development in young children with hearing loss (Moeller, Hoover, Putman, Arbataitis, Bohnenkamp, Peterson, Lewis, et al., 2007; Moeller, Hoover, Putman, Arbataitis, Bohnenkamp, Peterson, Wood, et al., 2007). According to ASHA, concrete words like "cat, jump, five, and red" are easier for children with hearing loss to learn than more abstract words, like "before, after, equal to, and jealous", and words that have multiple meanings are challenging (ASHA, 2015, p. 1).

The Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study followed 470 Australian children with hearing loss over a period of 5 years (Ching, Dillon, Leigh & Cupples, (2018). Their main conclusion was that early fitting of a hearing aid or cochlear implant is key for successful outcomes. With early intervention, researchers found better global language outcomes, better receptive and expressive language, and better speech perception in both quiet and noise (Ching et al., 2018).

Similarly, the Outcomes of Children with Hearing Loss (OCHL) study emphasised the importance of well-fitted and consistently worn hearing aids to protect against language delays (Moeller & Tomblin, 2015). The authors found that children with hearing loss (ranging from mild to severe) had poorer language outcomes during preschool when compared to their normal hearing peers, but high-quality caregiver language and use of amplification were positive influences on outcomes.

Literacy. Deficient phonological skills may also lead to difficulties in decoding, the reading practice of using orthographic information to recognise a word with respect to its phonological properties and therefore ascertain meaning. Even with intact phonological abilities, "weaker development of vocabulary, sentence and discourse skills" could affect reading comprehension (Moeller, Tomblin, et al., 2007, p. 747). According to Rayner,

Foorman, Perfetti, Pesetsky and Seidenberg (2001), reading skills, unlike language, must be explicitly taught. This means that a child with hearing loss is more likely to have a "poorer ability to profit from the language of instruction due to their weaker language skills", and is also vulnerable to missing oral instructions during instructional reading (Moeller, Tomblin, et al., 2007, p. 747).

A 2008 study of 85 North American children looked at the long-term outcomes of children who received cochlear implants at preschool age. They found that while early implantation resulted in long-term auditory and verbal development benefits, the majority of students did not achieve age-appropriate reading levels at high school (Geers, Tobey, Moog, & Brenner, 2008). In 2011 a study of 86 deaf adolescents using hearing aids or cochlear implants also found mean reading ages to be several years below chronological age (Harris & Terlektsi, 2010).

Overall academic achievement. If hearing loss is left untreated there is the potential for academic underachievement, with a widening difference between children with normal hearing and those with hearing loss as they progress through school (ASHA, 2015). In a review of academic achievement in children with hearing loss, the authors noted this large gap and postulated that lack of opportunity to learn (caused by language acquisition delays), or deficiency of curriculum and instruction for deaf children are possible causes (Qi & Mitchell, 2011). Whatever the reason, under achievement may lead to unrealised potential in higher education, employment or job performance (WHO, 2016).

Social skills. Children's interaction with their peers is an important component of their time at school. The social skills developed during childhood and teenage years are critical for success in society, including being able to form positive personal and professional relationships later in adult life (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Malecki & Elliott, 2002). In general, those who lack social skills are at risk for social

rejection and subsequent mental health problems that may persist during adulthood (Elksnin & Elksnin, 2006).

It has been suggested that difficulties in language and communication will result in experiential deficiencies that then lead to impaired social development (Meadow, 1980). Difficulties in communication caused by hearing loss may understandably cause frustration, anger, stress, or loneliness, which could impact interactions with others both at school and at home (WHO, 2016). Acting out in class is one possible warning sign that a child may be experiencing hearing loss and subsequent difficulties in social communication (Khairi Md Daud et al., 2009).

Classroom Listening

For all students, effective communication with their teachers and peers is a cornerstone of academic success. Children must be able to comprehend complex messages, converting spoken language into meaning (Lundsteen, 1979). This chapter examines some of the key factors that can negatively impact listening in the classroom for all learners.

Classroom noise level. During a typical school day, classroom activity will vary from silent independent work times with the expectation of silence, to bustling collaborative learning with elevated noise levels. Classroom sounds may be generated by speakers (both children and adults), electrical equipment (e.g. computers), classroom objects (e.g. moving chairs), or any number of external environmental sources (nearby traffic, machinery etc.). Any one of these individual sounds, and undoubtedly a combination of them, could interfere with a child's ability to hear their teacher. It is recommended that classroom noise levels not exceed 35 dBA (Crandell, 1991). A number of studies however have shown it typically ranges from 41 to 51 dBA (Bess, Sinclair, & Riggs, 1984; Crandell & Smaldino, 1994). Part of the teacher's role is to monitor the classroom noise level, consider the appropriate level for

the current activity and the needs of their students, and use appropriate behaviour management strategies as necessary.

In regards to effective communication, the absolute noise level is less important than the Signal-to-noise Ratio (SNR). SNR is a measure of how loud the desired signal (e.g. a teacher's voice) is, in comparison to unwanted background noise. A consistent SNR of approximately +6 dB is needed for people with normal hearing and listening to receive intelligible speech (Finitzo-Hieber & Tillman, 1978). This means that the speech must be 6 dB greater than the noise. Children in general find speech understanding more difficult than adults in the presence of competing noise (Wolfe et al., 2013). They therefore require a more favourable SNR than adults in order to understand speech in noise (Wolfe et al., 2013). According to Boothroyd (1997), a five-year-old typically needs a signal to be around 5 dB higher than an adult to recognise words with comparable accuracy to an adult. A (2013) study by Schafer et al. found that in particular, a normal hearing child's ability to determine details, reason, and understand messages is affected by excessive noise. According to ASHA (1995), teachers need to talk 15 dB louder than the background noise in the classroom. In a study that measured SNRs in 106 classrooms in 51 primary schools in the Wellington region, the overall median SNR was found to be +6 dB (Blake & Busby, 1994).

Classroom acoustics. Reflection of sound energy can benefit the listener by increasing the intensity of the received sound. A thoughtfully designed classroom will take this into account, using an appropriate combination of absorptive, reflective and diffusive surfaces strategically placed for maximum benefit (Berg, Blair, & Benson, 1996). Flat or curved surfaces made from stiff and hard materials primarily reflect sound, also influenced by the length and width of the surface in relation to the sound's wavelength (Berg et al., 1996). Porous, diaphragmatic or resonant surfaces absorb sound, and irregular surfaces will diffuse it (Berg et al., 1996; D'Antonio, 1989). When not properly controlled, reflection and absorption

of sound can interfere with classroom listening (Berg et al., 1996). A study by Finitzo-Heiber and Tillman (1978) demonstrated that all students can benefit from acoustically treated rooms, not just those with hearing impairment. This is reflected in the 2015 position statement from the New Zealand Audiological Society (NZAS), where it was emphasised that all children require an appropriate acoustic environment in order to learn effectively, but that it is especially important for those with hearing loss and other special needs.

Reverberation. Reverberation is the prolongation or repeated reflection of sound (Berg et al., 1996). Reverberation time (RT_{60}) is measured as the time taken for a signal to decrease in level by 60 dB within an enclosed space (Seep, Glosemeyer, Hulce, Linn, & Aytar, 2000). It is affected by room volume and the characteristics of the surface materials (Seep et al., 2000). The longer the RT_{60}, the greater the adverse effect on speech intelligibility (Knecht, Nelson, Whitelaw, & Feth, 2002). This is due to the vowels of speech masking the lower intensity consonants (Everest, 1989; Nabelek & Nabelek, 1985; Nabelek & Letowski, 1985; Nabelek & Robinson, 1982). According to Boothroyd (2012), an RT_{60} of around one second will significantly impact sound quality, and it is recommended that classroom RT_{60} not exceed 0.4s (ASHA, 1995; Finitzo-Hieber & Tillman, 1978). Crandall (1991) and Crandell & Bess (1986) reported that those with hearing loss have impaired speech recognition when RT_{60} is more than 0.4s to 0.5s. Unfortunately, typically measured values are anywhere between 0.4s and 1.25s, meaning that many classrooms have suboptimal RT_{60} values (Crandell, 1991; Crandell & Smaldino, 1994).

Direct and indirect sound. Students experience both direct and reflected sound in the classroom. Direct sound travels from a speaker to a listener in a straight line without being reflected by any objects, for example students listening to a teacher's voice in close proximity (Berg et al., 1996). Reflected sound strikes one or more objects on its path to the listener and is the most common type of sound perceived by those children positioned away

from their teacher (Berg et al., 1996). Since both direct sound and the power of the human voice are relatively weak, a combination of both types of sound enhance a child's listening experience and allow for effective communication (Davis & Davis, 1987; Everest, 1989; Fletcher, 1953).

Distance from the teacher. How loud a teacher's voice is will vary between individuals and may be influenced by their health. Speaking loudly for extended periods of time can for some teachers result in problems such as laryngitis, hoarseness or a sore throat (Palmer, 1997). With normal vocal effort a teacher's voice can be expected to be measured at a distance of three feet at 60 dB SPL or less (Brook & Uzzle, 1987). Sound intensity will decrease beyond this distance, influenced by several factors. According to the inverse square law, sound decreases by a 6 dB for each doubling in distance (Egan, 1988). Sound directionality and the presence of absorptive materials between speaker and listener (including other students) will also influence what reaches the listener (Egan, 1988). In order for a child to achieve maximum intelligibility they should ideally be within six feet of their teacher which is not always practically feasible (Crandell & Smaldino, 1994).

Other factors. Listening factors that can exacerbate a poor classroom environment may be categorised as either talker, language, or listener dependent (American Academy of Audiology [AAA], 2011). In the case of the talker, or teacher in this case, vocal effort, speech spectrum and rate, articulation, accent and orientation in relation to the person listening can have an impact (Bradlow, Torretta, & Pisoni, 1996; Brungart, Simpson, Ericson, & Scott, 2001; Iler Kirk, Pisoni, & Miyamoto, 1997; Krause & Braida, 2004; Payton, Uchanski, & Braida, 1994; Sommers, Kirk, & Pisoni, 1997). Language dependent factors include vocabulary, complexity of ideas or grammar, language context, and physical context (Fallon, Trehub, & Schneider, 2002; Ryalls & Pisoni, 1997). Factors contributed by the listener include their age (both chronologically and developmentally speaking), language knowledge

and competence, and whether or not communication is in their native language (Johnson, 2000; Mayo, Florentine, & Buus, 1997; Nelson, Kohnert, Sabur, & Shaw, 2005; Nittrouer & Boothroyd, 1990). Attention and cognitive status are further influences (Nober & Nober, 1975; Zentall & Shaw, 1980). Lastly, of course, the child's peripheral hearing ability and auditory processing abilities.

Some of these influences are beyond the control of the teacher, student or school, while some may be taken into consideration or actively modified to maximise listening opportunities.

Managing Hearing Loss in the Classroom

The majority of children with hearing loss are enrolled in mainstream schools and are educated alongside normal hearing peers, and this is considered to be an effective school setting provided that appropriate minor modifications are made (Brackett, 1997). In the auditory verbal classroom environment, accurate transmission and reception of speech is crucial, and a teacher may use a variety of strategies to ensure effective communication. (Smaldino & Flexer, 2014). Many modifications that benefit hearing impaired students will also be of benefit to the class as a whole.

As discussed above, distance between the speaker and listener will influence audibility, and a teacher may therefore encourage a hearing-impaired child to sit towards the front during group times. They may also carefully choose the location of a child's desk or table to maximise audibility. A teacher may monitor their vocal effort or speed, or choose their body position carefully when addressing the class to allow their lips to be read. Complementing aural information with visual enhancement such as also writing instructions on the board, or giving physical demonstrations, is effective for all learners (Brackett, 1997). The author suggests a preview-review strategy may be useful for hearing impaired students, where a learning support teacher reviews previously learnt material with the student and

gives them the opportunity to preview key vocabulary and concepts from future lessons. A mutually understanding relationship between teacher and student will enable open communication e.g. engaging in a process of requesting and providing clarification following a communication breakdown (Brackett, 1997).

Arguably the most effective strategy to help a child hear better in the classroom however, is the use of appropriate technology. Electronic devices that aid communication or awareness of environment sounds by giving the user visual, tactile or auditory information are known as hearing assistive technology (HAT). They include listening, alerting or signalling type devices, and may be used in conjunction with hearing aids or cochlear implants (Chisolm, Noe, McArdle, & Abrams, 2007). RM systems are one type of HAT that are frequently used to aid classroom listening. RM systems, as the subject of this thesis, will be discussed in depth below.

RM Systems

What is an RM system? This thesis will focus on the use of personal RM systems, which consist of two elements. Firstly, a microphone that captures the speech signal of a primary speaker. It is typically worn clipped to the speaker's clothing, in close proximity to their mouth. This short distance allows for a strong signal in comparison to the undesired background noise that may enter the hearing aid or cochlear implant microphone (Platz, 2004). The microphone may also be removed and used as a hand-held device or placed on a surface close to the speaker such as a table. This device then wirelessly transmits the speech signal to a receiver worn by the listener. This receiver may be connected to the listener's hearing aid(s), cochlear implant(s) or earpiece. Figure 1 shows this pictorially on the following page.

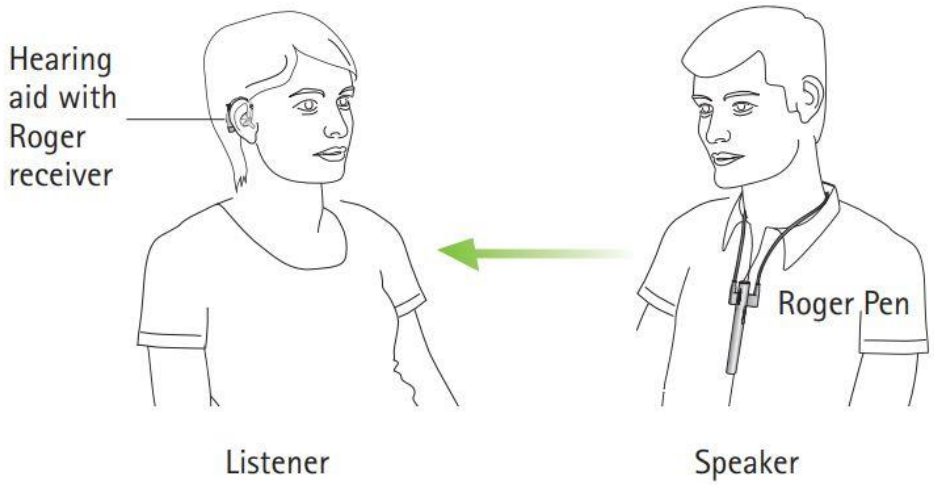

Figure 1 – How an RM system works, e.g. a Phonak Roger Pen™. ©Phonak. Reproduced with permission.

The result is an increased SNR ratio, maintaining SNR at a positive value (Sexton, 2003, as cited by Smaldino & Flexer, 2014). This essentially gives a student direct access to their teacher's voice (Wolfe, Lewis, & Eiten, 2016). The measured benefit in SNR ratio due to the use of an RM system, compared to the situation without an RM, is known as SNR advantage (Platz, 2004). This advantage can easily be as high as 20 dB. Ideally a fully transparent transfer of sound would occur with RM use, i.e. no alteration of the frequency or amplitude characteristics of the HA/CI signal, however this is not always possible, depending on the mixture of RM and HA/CI technology used (Platz, 2004).

Aside from the personal amplification device described above, RM technology for schools also exists in the form of sound-field systems or classroom audio distribution (CAD) systems (Wolfe et al., 2016). In this case, a microphone is still worn by the teacher but the signal is transmitted to one or more loudspeakers which are strategically located in the classroom. The aim is for a uniform distribution of the audio signal throughout the room, eliminating the disadvantage for children sitting further away from their teacher. This

technology also allows for the audio signal to originate from electronic devices such as a smart board, TV or computer as needed (Wolfe et al., 2016). Research suggests that sound field RM can improve SNR by 2 to 5 dB, resulting in improvements in literacy development, test scores, student behaviour, and a reduction in teacher absences (Chelius, 2004, as cited by Wolfe et al., 2016; Flexer & Long, 2003; Gertel, McCarty, & Schoff, 2004; Larsen & Blair, 2008; Massie & Dillon, 2006; Massie, Theodoros, McPherson, & Smaldino, 2004). Another possible option is an induction loop system using the telecoil of the child's hearing device (AAA, 2011). These technologies are not commonly used in New Zealand schools however and are not the focus of this thesis.

RM versus FM. In much of the literature cited for this thesis the term 'FM system' is used. The abbreviation FM has been used to indicate the use of a frequency modulated signal for transmission. As discussed by the AAA (2011), this used to be the most common type of personal wireless technology, but other carrier and modulation options are now available and as such the accepted generic term is RM. The abbreviation RM will be used throughout this study except when referencing older FM research studies.

Types of personal RM. There are currently a range of personal RM devices available for purchase through several different audiological manufacturers. Compatibility with a child's hearing aid(s) or cochlear implant(s) is one factor that affects the choice of RM system. Many schools use one of the 'Roger™' devices made by Swiss manufacturer Phonak, such as the Roger Pen™ shown on the next page in Figure 2.

Figure 2 – Phonak Roger Pen™. ©Phonak. Reproduced with permission.

Different features in different types of RM also provide the opportunity to purchase the device most appropriate for the listener's needs. Some RM devices have the capability for multiple student users to connect to one teacher's microphone, or in team teaching situations, for multiple teachers to be able to transmit to one student user (Phonak, n.d.-b).

Who might benefit from an RM system? An RM system can be used with different types of personal hearing devices, and while peripheral hearing loss is a common reason for a child to be using an RM, the increase in SNR may also be beneficial to students with other needs. Both groups are discussed below.

Hearing aid and cochlear implant users. Hearing aids are unfortunately not designed to deal with all of a person's listening needs, and benefit can be limited when there is competing noise, when the speaker is far away, or when both of these conditions exist (Dillon, 2012). An RM system may be used in addition to hearing aids to provide a clearer and more complete speech signal when the talker is unable to speak within the hearing aid user's optimal listening range. An RM system can be used with both air conduction and bone conduction style hearing aids (Wolfe et al., 2016). The receiver may be integrated into the design of the aid, or may come as a separate attachment (Phonak, n.d.-a). Similarly, with

cochlear implants, the RM receiver is attached to the processor. The RM speech signal is mixed with the processor microphone signal and encoded for stimulation of the electrodes.

Most children using an RM will have their hearing aid or cochlear implant microphone live for environmental sounds while simultaneously receiving the RM signal from their teacher (Platz, 2004). ASHA defines FM advantage as the strength of the FM signal in comparison to the strength of the hearing instrument microphone signal, for a situation where the speaker and the FM user are two meters apart (ASHA, 2002). Figure 3 shows how the voice of a teacher may be picked up at around 80 dB SPL by the FM microphone 30 cm away from their mouth, but that after travelling a distance of 2 m to a child's hearing aid microphone, the signal will have decreased to around 65 dB. This results in the FM signal being louder (Platz, 2004). ASHA guidelines recommend that the FM signal should sound 10 dB louder at the output of the hearing instrument, i.e. an FM advantage of 10 dB (ASHA, 2002). The aim is to maximise speech intelligibility for the child, whilst still allowing them to be connected to their immediate environment via the hearing instrument microphone (Platz, 2004).

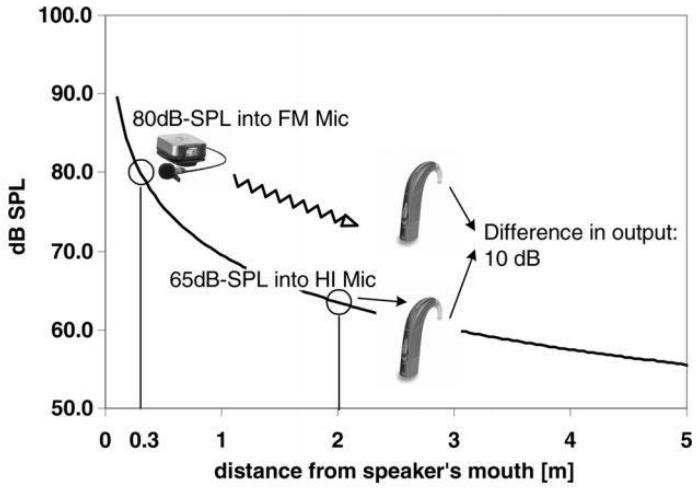

Figure 3 - Definition of FM advantage according to ASHA guidelines. Copyright 2004 by Platz. Reproduced with permission.

Users with APD. In addition to those using RM systems connected to hearing aids or cochlear implants to aid hearing losses, an RM may also be considered for those who have normal hearing thresholds but who may benefit from an increased SNR for whatever reason, including APD. A 2016 systematic review by Reynolds et al. indicated moderate support for the use of RM systems by children with APD, due to consistently positive findings with some limitations (such as small sample size). The authors recommended that RM use should be considered as part of an intervention program (Reynolds et al., 2015).

Users with other learning difficulties and diagnoses. RM systems have also been investigated for their effectiveness with children that have a range of other learning or behavioural challenges e.g. Autism Spectrum Disorder (ASD) and/or Attention-Deficit Hyperactivity Disorder (ADHD). An initial investigation by Schafer et al. (2013) examined RM effectiveness with a group of 11 such children by measuring speech recognition performance in noise and observed classroom behaviour, as well as teacher-rated educational risk and listening behaviours. In this study, RM use brought the children's poorer than average speech recognition scores up to a level comparable with their typically functioning peers. Teachers also noticed a significant increase in on-task behaviours and improvement in average listening behaviours. Their results led the authors to conclude that RM use may be considered for ASD/ADHD children when coupled with audiological evaluation and a functional evaluation of the device in a child's own learning environment to determine individual benefit (Schafer, Mathews, et al., 2013).

Research supporting RM use in the classroom. A recent systematic review looked at speech perception benefits in noise for children using hearing aids and/or cochlear implants with an FM system at school, including three types of FM system – personal, desktop, and free field (Bertachini et al., 2015). The authors found that all selected papers were in support of FM systems improving speech perception and speech threshold in noise, with personal FM

systems being most beneficial, followed by desktop FM and free field. This study was limited by the small sample size (n=8), and a final recommendation was given that further research should focus not on speech perception but impact on overall school performance (Bertachini et al., 2015).

Part of this systematic review was a New Zealand based study by Davies, Yellon and Purdy (2001), looking at FM benefit for children wearing cochlear implants, to address the lack of information in comparison to FM benefit with hearing aids. The participants were 14 children with cochlear implants, aged between seven and 17 years of age, and all were part of an oral/aural communication education setting and used the SPEAK™ speech coding strategy. The majority of participants had previous FM experience: 10 children used a personal FM in their classrooms regularly; one used a sound-field FM system; three did not use any kind of FM system. Speech perception was measured using HINT test sentences. To simulate the experience of a child listening at school, a recording was taken from a typical New Zealand classroom in Auckland, which was then used as background noise played simultaneously from four loudspeakers. The authors reported a statistically significant main effect of FM use on HINT scores, demonstrating that benefit was experienced for the 0 and -3 dB SNR conditions (Davies et al., 2001). Greater benefit was obtained for older students and those with experience, and younger students had more variable results, while the effect of SNR was found to not be statistically significant (Davies et al., 2001).

Optimal use of RM systems. Despite demonstrated effectiveness in a research context, appropriate management of the RM system by both the student user and their teacher is an important consideration. Miranda and Brazorotto (2018) concluded that the main facilitator for optimal classroom RM use was the teacher's knowledge of how to use it, and recommended research into the adaptation and training of the school community in RM system use. Further studies have identified cooperation between family and school, and

attitudes towards those with hearing loss to be fundamental (Rocha & Scharlach, as cited by Miranda & Brazorotto, 2018; Oliveira et al., 2015, as cited by Miranda & Brazorotto, 2018). If difficulties arise it is important to ascertain whether it is an issue of faulty equipment, improper set up, or user error (Flexer, 1997). Classroom observation may be useful to aid in troubleshooting difficulties experienced when it is thought that a child is not receiving any benefit from their RM (Flexer, 1997).

To avoid difficulties, in the first instance it is crucial that a paediatric or educational audiologist is involved in the recommendation, selection and fitting of the RM (Smaldino & Flexer, 2014). Ongoing audiological monitoring of the child as well as appropriate support from other hearing professionals is important for success. A student may have a primary teacher (or more than one) at the time of acquiring the device, however they are likely to also have interactions with other teachers, teacher aides, learning support workers etc. as well as their peers, all of whom could participate in education on RM use in order to benefit the student user.

A document written by audiologist Paul Peryman and distributed by Van Asch Deaf Education Centre (VADEC) in Christchurch describes key points to consider for effective use of an RM system (Peryman, 2017). First and foremost is the need for the teacher's microphone (RM transmitter) to be placed on charge every night. The teacher's daily tasks are described as checking with the child that the RM is working, and wearing the transmitting microphone high in the centre of the chest. Recommended communication strategies for working with a child that uses an RM include introducing topics before entering into lengthy discussion, encouraging children to speak one at a time, repeating other children's questions or comments so they can be picked up by the microphone, facing the child when speaking, and making sure they are attending before anything important is said. The information sheet

also informs teachers that their RM has the capability to connect with devices such as a television or computer for audio streaming.

Further, this VADEC document (Peryman, 2017) outlines precautions that teachers must take. It is recommended that the teacher minimise background noise in the classroom. They must turn off or mute their transmitting microphone when the child with hearing loss does not need to hear what the teacher is saying, and when the teacher leaves the room. Care should be taken to avoid knocking the transmitter, as the listener may experience these as sudden loud sounds. When passing the microphone around a group, Peryman (2017, p. 1) recommends that the teacher "show children how to hold the transmitter so that the microphone inlets are not covered/touched". There is also a reminder that listening fatigue may influence a child's ability to hear and understand speech, regardless of whether they are using their RM. Checking with a child to make sure they have understood important messages is still therefore recommended.

The New Zealand Context

In order to narrow the reader's focus to the geographical area of this research, the following section presents information specifically relevant to children with hearing loss in New Zealand.

New Zealand Classrooms. As previously stated, elements of the classroom environment such as the acoustics, reverberation and noise level have a significant impact on a child's ability to learn effectively. A key feature of the New Zealand context is the recent shift towards 'Innovative Learning Environments' (ILEs) rather than traditional single cell classrooms. These large open spaces are shared between multiple classes of children and are designed to facilitate collaborative teaching and learning (Ministry of Education - Te Tāhuhu o Te Mātauranga [MoE], n.d.). In theory they are designed to ensure the acoustics, lighting, technology, heating and air quality are of a high standard that will support children's learning

(MoE, n.d.). In practice they are somewhat controversial. Depending on how well the idea has been implemented (in regard to both the building's physical characteristics and how the space is used practically by teachers and students), they can range from successfully collaborative to chaotic and noisy spaces.

Support for hearing impaired children in New Zealand. Children with hearing loss in New Zealand are typically part of mainstream classes, and follow the same curriculum as other school children. Those who have specific learning needs may have an Individual Education Plan (IEP) to address any modifications needed, for example to the learning material, or methods of instruction.

There are a number of professionals and organisations that may be involved with a child's care in New Zealand. The provision of Deaf Education Services in New Zealand is currently overseen by two Deaf Education Centres (VADEC in Christchurch, and Kelston Deaf Education Centre in Auckland [KDEC]), although work is underway to combine them into one national organisation (VADEC, 2018). Resource Teachers of the Deaf (RTDs) work in the classroom alongside hearing impaired children and their peers, or in a one-to-one or home school setting. They work through the Deaf Education Centres, and can modify the New Zealand curriculum according to the needs of the child (MoE, 2018).

Through funding from the MoE, Advisers on Deaf Children (AoDCs) work to provide support and guidance to the hearing-impaired student (from birth to Year Three), as well as their family and their school (MoE, 2018). ASSIST Specialist teachers carry on the work of the AoDCs, providing support from Year Four until the child leaves school. For high needs children, funding and resources may be provided through the Ongoing Resourcing Scheme (ORS) e.g. time with a teacher aide. The MoH is responsible for funding the provision of hearing aids for children, and RM technology for pre-school aged children and tertiary students (MoH, 2017a). The MoE however provides the funding for RM systems for school-

aged children because the MoH deems them to be primarily required in classroom settings (MoH, 2017b).

Two organisations oversee a patient's cochlear implant journey from initial assessment through to post-implantation rehabilitation. The Northern Cochlear Implant Programme (NCIP) covers parts of the country north of Taupo, and The Southern Cochlear Implant Programme (SCIP) serves the remaining area.

Deaf Aotearoa is an organisation that provides knowledge, information, and resources to support the New Zealand deaf community, for example working with government agencies and businesses. Deaf Children New Zealand is a volunteer organisation led by parents, that works to support the families of Deaf and Hard of Hearing children in New Zealand (Deaf Children New Zealand, 2019).

RM system users in New Zealand. Information on the number of children using RM systems in New Zealand was sought from J. Simpson, the National Coordinator of Assistive Technology at the MoE. The information provided is shown in Table 1 on the following page.

According to J. Simpson, the majority of children allocated an RM have some kind of hearing loss (either sensorineural or conductive), while around 20-25% use one because of APD (personal communication, November 21, 2019). As shown on the following page in Table 1, allocation of RM systems in New Zealand has increased over the last two years.

Table 1

Number of RM Systems Allocated to New Zealand Children

Calendar Year	Auditory Processing Disorder	Hearing Loss (Sensorineural or Conductive)
2019	184	515
2018	160	446
2017	108	441

Note. Data above does not account for any New Zealand children who currently use an RM system that has been obtained through private funding.

New Zealand teachers' current knowledge of hearing loss. Coombe (2018) investigated New Zealand primary school teachers' knowledge of hearing impairment and deafness. The study concluded that teachers require more information and education around effective teaching and learning strategies for hearing impaired and deaf children, with the author noting that this information gap had also been reported more than 30 years previously. The resources reported as being most commonly used were the children's parents, the children themselves and paraprofessionals in the education system (Coombe, 2018).

The Deaf Education Centres' online learning modules mentioned by Coombe as in development have been written, produced and are now being pilot tested with teachers (S. Beaton, personal communication, February 25, 2019). The topics are as follows: How the Ear Works; Hearing Aids; Cochlear Implants; RM Systems; The Classroom Environment; The Daily Check (S. Beaton, personal communication, February 25, 2019). In current development are the following modules: BCHAs; Audiograms; Unilateral Hearing Loss, with plans to develop further topics (S. Beaton, personal communication, February 25, 2019). Results from testing are not yet available.

The present research provides information further to Coombe's study on how successful the current support system is for children with hearing loss.

Study Rationale

Information currently available. Supported by research demonstrating their effectiveness, a large number of RM devices are currently being used by New Zealand students, as shown in Table 1. As identified by associate supervisor for this research, Paul Peryman (audiologist at VADEC in Christchurch), there is a need for research to be done into how effectively these systems are currently being used and what the current barriers are to their optimal use. The present study aimed to achieve this, from the perspective of both teacher and student. In a search of current international literature, no qualitative studies about teacher and student experiences with remote microphone systems were found. Scholarly reports of the educational experiences of deaf children and their teachers were in general limited. Where found, these tended to focus on teacher perceptions of their own preparedness for teaching deaf students, inclusion, and student self-perception rather than their experiences with HAT (Cates, 1991; Hansen, 2014; Musyoka, Gentry, & Meek, 2017; Sebald, 2013).

Researcher's interest. This project was of particular interest to the author because of their professional background in teaching before studying audiology. The author completed a Graduate Diploma in Teaching and Learning (Primary) in 2012 and in the following years worked as a teacher in both Christchurch and Dunedin. This briefly involved working with a student that was experienced in using an RM system. As a teacher new to using an RM, the author was given minimal information on how to use the device e.g. turning it off and on, and the fact that the student would take it off them at the end of lessons. The author's interest in this project was therefore partially born out of curiosity over whether other teachers were having similar experiences.

Aims and Research Questions

The two research questions posed in this study were:

1. What are the common teacher and student experiences (positive and negative) of RM system use in classrooms?
2. What types of extra support might be needed for effective RM system use in classrooms, as suggested by teachers?

In summary, this chapter has addressed the causes and effects of hearing loss in children, what steps are generally taken to address childhood hearing loss internationally, and the specific context of New Zealand. The reason for initiating this research has been explained, and the questions to be answered are stated above. The following chapter provides a detailed account of the methodology used for this study.

Method

Ethics

This project was approved by the University of Canterbury Educational Research Human Ethics Committee on Tuesday 11th June, 2019 (See Appendix C). Two amendment requests (on the 20th and 27th of July) were approved for changes to the information and consent documents that were needed for the second phase of recruitment, for the AoDCs and RTDs.

Research Design

Qualitative research. Research methods may be placed on a spectrum of quantitative to qualitative. Quantitative studies examine data in the form of facts, numbers, and/or percentages etc. Qualitative studies on the other hand, deal with data in the form of spoken or written words, pictures or moving images (Knudsen et al., 2012). As noted by Knudsen et al. (2012, p. 84), they attempt to "understand, gain insight, and describe human meaning making, behaviours, and beliefs". Since the objective of this research was to hear the stories of RM users and gain an understanding of their experiences and opinions, a qualitative research design was most appropriate. The approach used for this study is an inductive one, where the data itself drives the formation of ideas, rather than a deductive approach where an already established theory is confirmed, denied or expanded (Knudsen et al., 2012).

Interview questions. The areas of focus in this study were the teacher and student experiences of RM system use. A variety of factors were identified that may have influenced the participants' experiences, including:

- student and teacher age, gender, ethnicity and socioeconomic status
- student diagnosis (e.g. hearing loss, APD etc.)
- classroom environment (whether single-cell or ILE)

- experience of the teacher (in both general education and RM use)
- how long the RM system has been used by the student
- what type of RM system is being used, and
- what support the teacher and student have had e.g. AoDC.

Considering the information above, two sets of interview questions were devised: one for the teachers and one for the students (See Appendix D; Appendix E). These questions allowed for the collection of information on influencing factors (e.g. teaching experience), and also gave each interviewee a chance to describe their experiences using the RM.

Information, consent and assent documents. Separate study information letters and consent forms were developed for principals, teachers and parent/caregiver(s), with wording changed depending on how contact was made: through Facebook; an AoDC; or an RTD (See Appendices F - N). The information letters described the purpose and methods of the study and were distributed via email. Consent forms were collected before interviews took place, either electronically or in person.

To facilitate open and honest conversations with the students (who may have been hesitant to describe difficulties), it was decided that students would not be interviewed at the same time as their teacher. Each teacher was asked to organise for an interview observer (such as a deputy principal or teacher aide) to be present. Information sheets and confidentiality forms were also sent for an interview observer who would accompany each student for general health and safety reasons and to ensure the student was comfortable (See Appendix O).

Immediately before any interview took place with a student, an assent process was used to ascertain whether the student was happy to speak about their experiences with their RM. A printed Powerpoint slide show was used to explain the interview process to each child

in simple language (See Appendix P). An assent form with either tick boxes or smiley faces to colour in was then used to allow each child to indicate their understanding of the task and desire to participate (See Appendix Q; Appendix R).

Participants

Inclusion criteria. This study aimed to interview mainstream primary school teachers in Canterbury, New Zealand, and their students, who were currently using an RM system in their classroom. In New Zealand, Years Seven and Eight (approximate ages 12 to 13) may be either included as part of a 'full primary' school (New Entrant to Year Eight) or be the first two years of high school (Year Seven – Year 13). The researcher decided to limit the search to teachers and students in the main primary years (New Entrant to Year Six), with students therefore aged between five and 11 years of age. The researcher intended to include a range of schools in the Canterbury region, both public and private, and any classroom style from traditional single-cell classrooms, to large ILEs. To ensure the results were meaningful and best reflected the general experience of RM use in Canterbury classrooms, the aim was to interview at least five teachers and five students. It was decided that a range of ages, hearing needs and types of devices used would be included.

The Canterbury region was chosen mainly for logistical reasons, with the researcher residing in this location and the city having a sufficient population size to locate participants. As previously mentioned, there is a nationwide shift towards ILE style classrooms for new builds. Canterbury has a somewhat unique context, having been the location for a significant earthquake in September 2010, and a large, destructive aftershock in February 2011. Due to these events a large number of classrooms have been rebuilt, with a focus on ILEs.

Only participants who had used their RM for at least two terms were included in this study. The purpose of this was to eliminate the influence of the RM being new (potential

difficulty in using the system, or having an overly optimistic view of the device due to its novelty).

On the parent/caregiver information sheet and consent form, permission was sought for the researcher to contact each child's support team, to determine whether or not their RM system had been appropriately verified by an audiologist. Information on how this is done in New Zealand for hearing aid wearers is available in Appendix 19 in the UNHSEIP document (MoH, 2016). This verification process is done to ensure transparency. This means that there is no change in the frequency response and gain of the hearing aid measured in a coupler when the test signal is fed to the aid via the RM transmitter vs to the aid by itself.

In the case of cochlear implant users, although there is no truly objective method, steps can still be taken for verification. At SCIP the protocol involves an audiologist first performing a listening check of the equipment before the fitting appointment (S. Weusten, personal communication, October 15, 2019). At the fitting, age-appropriate speech testing is performed for each ear separately while using the RM transmitter. The organisation also has the benefit of having cochlear implant users on staff who are involved in testing equipment and providing feedback (S. Weusten, personal communication, October 15, 2019).

While it would have been preferable to exclude participants who had not had their RM system verified, this was not practically feasible in this study. Information on whether or not verification had taken place was not readily available e.g. in several cases it was presumed to have been done but there was no specific information noted in the child's file. It was therefore decided that the information would be noted, but would not affect whether or not a child was included in the study. Verification was confirmed for two of the eight children.

Recruitment process. The first phase of recruitment involved contacting teachers in the Canterbury area. An advertisement was posted on the 'NZ Teachers (Primary)' Facebook group which (at the time of writing) has over 35,000 members (See Appendix S). This advert explained the purpose of the study and the inclusion criteria, and invited interested teachers to get in contact to receive a full information pack with consent forms for their principal and the student's parent/caregiver(s).

For the second phase, contact was then made with local RTDs and AoDCs with the help of Paul Peryman at VADEC. The researcher spoke with the RTDs in person, while an email was sent to the AoDCs (See Appendix T). Both groups were invited to pass on the study information to the parent/caregiver(s) of the children they work with that were eligible for the study. After a parent/caregiver consent form was received, contact was made with the school to inform the principal and teacher of the study, and to invite the teacher to participate.

Participant information. The seven teachers interviewed in this study ranged from beginning teachers, to those with nearly two decades of experience. Since interviews took place at schools, the researcher was able to see the variety of classrooms and teaching spaces used. Two worked in traditional single-cell classrooms, while the others were housed in larger buildings designed to support collaboration between teachers and student groups. Three teachers worked 'in the power of two' style with their neighbouring class, and the others had larger and more open ILE spaces. Teachers' experience of RM use ranged from two terms with their current student, to five years with multiple students. They all had at least one current student using RM, and in one case, two students. All teachers were users of the Phonak Roger Pen™, and one teacher also had a Phonak RemoteMic. In no particular order, pseudonyms assigned to teachers were: Katie; Annabelle; Steven; Jane; Miranda; Vanessa; and Claire.

The students interviewed for this study had a variety of hearing and communication needs. Two were diagnosed with APD, two were hearing aid users, three had bilateral cochlear implants and one was a 'Bonebridge' bone conduction implant user. All had been using their RM for at least two terms (20 weeks), some much longer. The youngest student was in a Year Three class, and the oldest a Year Six class i.e. an age range of seven years to 11 years of age. In no particular order, pseudonyms assigned to students were: Ben; Zoe; Louis; George; David; Noah; Olivia; and William.

The author has chosen not to present the exact age and hearing needs of each child, in order to support confidentiality. Due to the small sample size it would otherwise be possible for a teacher to identify their own student's comments. Telling each student participant that their teacher would not be told what they shared, positive or negative, was an important part of putting the child at ease to facilitate open and honest conversation.

Data Collection

Collection of initial participant information. Some initial information was collected from teachers via email e.g. the age of the student using the RM, and how long they had been using the RM for. The purpose of this was to identify those candidates that may have expressed an interest in being interviewed but didn't meet the inclusion criteria.

Avoiding bias. Consideration was given to the fact that the researcher's personal experience had potential to introduce bias. Participants were informed that the researcher had experience as a primary school teacher and in using an RM system. However, the researcher's experiences and opinions in regard to RM systems were not shared prior to or during the interviews to avoid any influence on the data.

Interviewing. Fifteen semi-structured interviews were completed. Seven of these were with teachers, and eight with students. The semi-structured format meant that while

there was a similar structure to each one, questions were not necessarily read in the order on the sheet as the interview was guided by the responses of the interviewee. Several additional questions were added when appropriate to allow for the person to expand on the current topic of conversation (e.g., “Do you think the main barrier to teachers using them is their lack of knowledge?”).

Teacher interviews took place after school hours (e.g. 4 pm) and generally lasted around 20 to 40 minutes of recorded time. The student interviews that took place afterwards were booked during the school day at a convenient time for the child, and were much shorter at around five to 10 minutes. Each conversation was recorded with the use of two electronic devices and audio files were uploaded to the University server on the same day.

Interview transcription. As soon as practical after each interview, each audio recording was reviewed and transcribed by hand into a Microsoft Word document. This method was chosen over using computer assisted or outsourced transcription services for three reasons: the relatively small data set; the researcher’s competent typing ability; and a desire to maximise familiarity with the data. In order to capture the true voice of each participant, each interview was transcribed exactly as heard. Some quotes may therefore contain grammar and sentence errors as spoken by the teacher or student.

Data Analysis

A six-phase approach to thematic analysis was undertaken as outlined by Braun and Clarke (2012) and described below:

The first phase of thematic analysis involved immersion into the data. After each individual interview was transcribed, the document was printed and read while handwritten annotations were added on the side. The purpose of these notes was to aid familiarisation and to record initial observations and ideas for future in-depth analysis (Braun & Clarke, 2012).

These hardcopies were stored until all interviews were completed. The researcher then revisited the data set as a whole by re-reading all 15 interviews while simultaneously listening to the audio recordings. At this stage further handwritten notes were added, with highlighter and underlining used to identify key parts. The researcher focused on deeper meaning, including the interviewee's beliefs, attitudes and values as well as behaviour patterns, actions and events (Grbich, 2013).

During the second phase all transcription documents were imported into NVivo 12 Plus software for the purpose of labelling key parts or 'coding'. The data was re-read and coded with both descriptive and interpretative key words and phrases (Braun & Clarke, 2012). Codes or 'nodes' as they are known in NVivo, were applied to sections of the text anywhere from single words to large chunks, and some parts of the transcript were left uncoded since they were deemed irrelevant to answering the research questions (Braun & Clarke, 2012). In some cases, more than one code was applied to a section. During the coding process new codes were continually added and existing codes were edited and reorganised. NVivo allowed for the grouping of codes into categories to facilitate this e.g. under the main node of 'feelings' were anxiety, confidence, contentment etc.

According to Braun and Clark (2006, p. 82) a theme "captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set". For the third phase the codes were reviewed and a search was done for areas of similarity and overlap that could be consolidated into a broader, overarching theme that would reflect a meaningful pattern in the data. The objective here was to construct themes that were distinctive and had little overlap, but when put together formed a cohesive group of ideas that told the overall story of the teachers and students (Braun & Clarke, 2012). These ideas were then represented in a thematic map (See Figure 4).

In the fourth phase the developed themes were reviewed in relation to data extracts, the dataset as a whole, and the overall research questions to be answered. Changes were made as needed.

For each theme the general idea was condensed into a defining phrase that conveyed its essence, with clear focus, scope and purpose (Braun & Clarke, 2012). At this point, samples of transcripts were sent to the researcher's secondary supervisor (Paul Peryman), who was asked to note key themes without having seen the researcher's own themes. This provided a valuable cross check to increase the reliability of the study.

In the sixth and final phase, the themes were reported by writing up the results and discussing the issues raised by the participants' experiences in the context of relevant research.

In summary, this chapter has outlined the actions taken by the researcher in order to investigate the key research questions, including the design of the study, recruitment process, interviewing and data analysis. The following chapter presents the findings of the study in the form of a thematic map (See Figure 4), and interview excerpts.

Results

In this chapter, the results of the study are first presented in the form of a thematic map (See Figure 4). Four overarching themes were identified: A highly valued piece of technology; Attitude affects outcome; Success through collaboration; It's just part of the norm. Each of these overarching themes contains three sub-themes, as demonstrated by the smaller boxes in Figure 4. All themes are discussed below and supported with interview excerpts from both teachers and students.

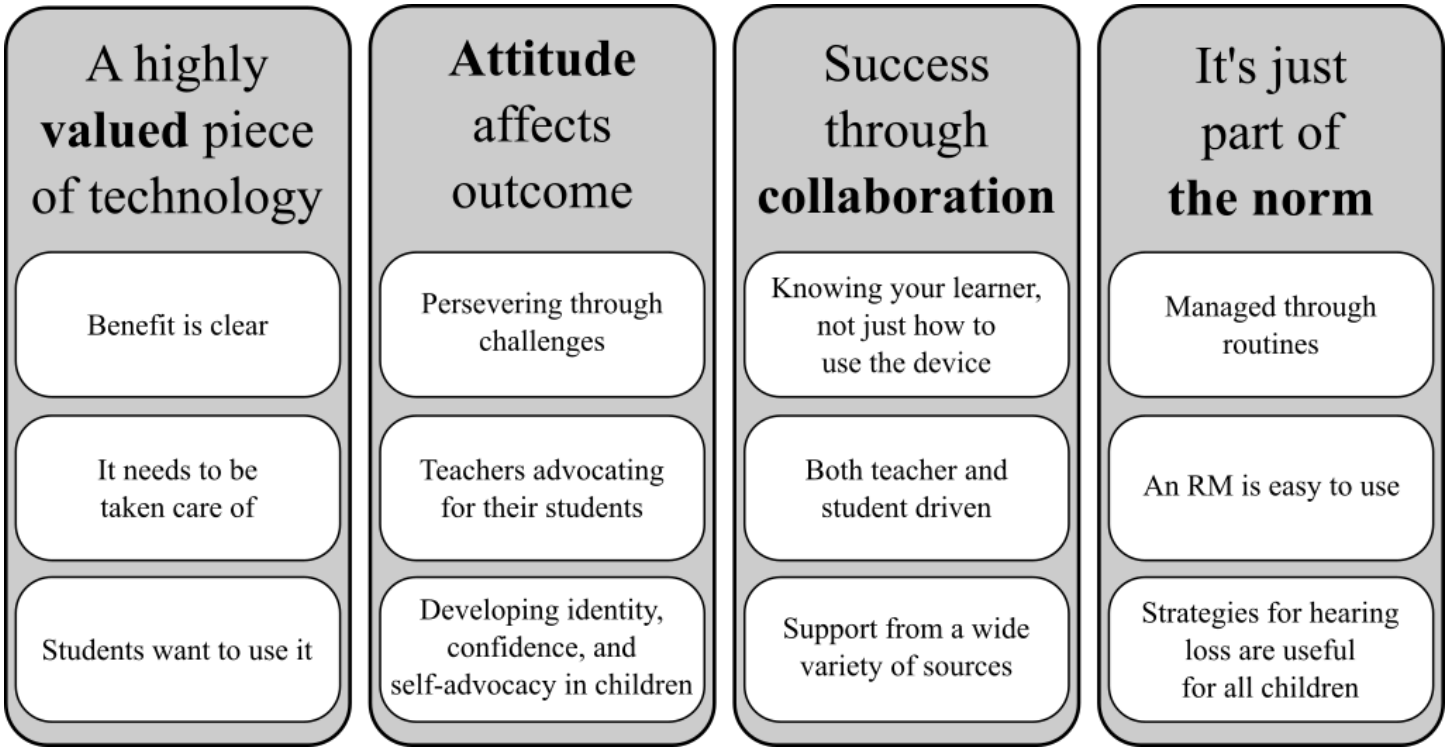

Figure 4 - Thematic map of teacher and student experiences.

A Highly Valued Piece of Technology

Benefit is clear. As discussed earlier in this thesis, classroom noise level is one of the contributing factors that can make school a challenging listening environment. When asked about the typical noise levels in their classroom, teachers in both single-cell classrooms and ILEs commented that the noise level varies depending on the time of day and what the children were doing. Collaboration was recognised as a key feature of modern learning and as such there were often times were the class was filled with "a working noise" or "busy chatter". It was clear in all interviews with teachers that the RM was highly valued for the communication advantage it was giving their students. All seven teachers confirmed without hesitation that their student received benefit, using words such as "definitely" and "absolutely". As Steven said, "It is a really, really amazing device… and we're lucky to have one so that (Student) can hear us." Jane, who uses an RM with two of her students, noticed that,

> there's a considerable difference between whether they're wearing them or not wearing them… (Student) cannot hear without it. He won't acknowledge if you're speaking to him in the classroom because he just cannot hear, and then he gets really, really lost in what he's doing, um, academically, because he has no idea what's going on. (Student 2) can manage without it, but the RM system is so much a support for him that again without it there is a noticeable difference.

While conducting interviews the researcher felt that teachers were grateful for both the development of the technology and that they had been able to receive funding for one. Miranda said, "They're great, I just think they must have helped children so much since they've come into being." The children themselves were able to describe in mostly simple language that the RM worked well for them. Olivia remarked that it helped her to hear

"mostly all the times." Articulate student Zoe commented that she was "thankful" for her RM, and that it made her "feel included".

It needs to be taken care of. Reverence towards RMs is further demonstrated in the care that is taken by teachers and most students to ensure that the device does not become broken or damaged. Claire said, "We're quite protective of it because it is so expensive". Vanessa commented about other students in the class using it, "They feel, you know, quite special and it's like they're speaking into a microphone. But they're really, um, sensible." In some cases, this mindful attitude was unprompted by the teacher, while in other cases a conversation was had with the student user and/or their classmates to help instil this sense of responsibility. Only one teacher, Katie, spoke to the researcher about needing to remind students when they were being "little boy silly" with it by "being quite loud into it, or, um, swinging it like a poi." The possible negative impact of schools placing such high value on the device is a sense of anxiety around keeping it safe. In Claire's case, this appeared to be stopping her from using the RM to its full potential as she described that they didn't let other children wear it around their neck, and a new reliever would not be invited to use it by a teacher (although the student themselves could potentially hand it to them). Claire, as will be discussed later in the results, was a teacher that received little support for using the RM so this lack of confidence may be related.

Students want to use it. Apart from the students themselves saying that their RM helps them to hear better, teachers commented that they knew it helped since the students were active in wanting to use it. Self-management of the device was a frequent topic of conversation during the teacher interviews. They described students being responsible for taking the RM off a teacher and handing it to another, making decisions about when they do and don't need to be using it, making sure it's charged, and keeping track of its whereabouts. Claire reported her student will,

> just go and take it to that teacher and hand it to them. Um and it, she has it turned on ready to go so they just need to clip it around and then when she's going to her group she'll just walk up to the teacher and they'll automatically know that what she's come up for. And then she'll take it with her. She's very good at managing it herself.

Student David said that when his teacher forgets to wear it, he goes and gets it himself. Only in one case did a teacher (Annabelle) recount their student initially trying to avoid using their RM, in this case by leaving their receivers at home. She noted she had seen improvement in his attitude over the year.

Attitude Affects Outcome

Persevering through challenges. The researcher identified student and teacher attitudes to be relevant to the success of RM use. Despite the numerous difficulties that both parties reported they had experienced while using their RM system, they remained happy with the device overall. It was clear that persevering through challenges and remaining positive was a common experience of all interviewees, and that the overall benefit of the device outweighed the negatives. Problems shared included: not connecting; connecting to one ear only; connecting to two teachers by mistake; not charging or holding charge properly; and having to take devices off the child's ears to connect. Jane described managing her two students using Roger™ Focus:

> Probably the biggest challenge is when it's not working and you're in the middle of doing something with all the kids and you can't stop and so then you've got one child who, their system's not working. You can't help them right now because you just, you can't stop for like 20 minutes to sort this out… We've had to do a lot of troubleshooting, um, since we've had them…we try batteries and all sorts, and then you'd change the tube and they're a bit fiddly but we get there. We get there in the end.

Other challenges mentioned were about the daily organisation and management of the device, rather than any problem with the device itself. Katie said,

> we had to rescue it today, the Kapa Haka tutor had taken it home, so being aware of where it is at all times! Sometimes we've… attached it to the TV because he's got a cable that runs through the TV into it. Um, unplugging it from there to put on charge overnight. Sometimes it's been left on the TV and not charging.

It was clear that for all teachers there had been an initial period of getting used to using the RM, supporting the decision to only interview teachers who had been through that initial learning stage. Miranda said, "We've got it down to a fine art now. It's only taken two terms."

Teachers advocating for their students. When asked about challenges, laughing to herself, Annabelle recounted a story about how she had asked her student to give the Roger™ to the principal so that they could hear during a whole school assembly, and afterwards she went "ballistic" at her colleagues for not using it:

> I was like, "You know we've got this technology and, you know, everybody needs to have the…same opportunities and the same access to information and you… completely cleared the deck with him. Um, that was a whole hour where he didn't hear anything." And he was like "He (the student) didn't come and see me", and I was like "Oh!".

Despite the misunderstanding of the situation, firstly, this teacher demonstrated an understanding of the poor listening experience of the student. Likely in a large reverberant space with a microphone being used and a baby crying in the background, Annabelle knew how important the RM was. Secondly, she demonstrated a strongly supportive attitude towards her student's needs not just inside the classroom: "I'm (his) advocate here at school

and so I need to make sure that I am advocating for him at every opportunity." Many of the teachers spoke of how despite their hearing difficulties, their student was happy and achieving well. Miranda described her student as "capable" and "confident".

Developing identity, confidence, and self-advocacy in children. Students' attitudes towards their hearing loss also appeared to affect RM use. According to Annabelle her student initially "didn't want anyone to know that Roger™ was specifically for him." One student, Noah, said that he felt a bit shy about using his RM, and that he wanted to "be with the others…like (a) normal person".

While all the students I interviewed knew that their RM helped them to hear, only a few children were able to tell me more about why they needed that help to hear, for example that "something in my ear is not formed right," and "because I'm deaf, I can't hear as well as other hearing people." They also had very limited knowledge on what the RM was doing. One student, Louis, creatively described his RM as being "pretty much like a teleporter that like, you could hear," but when asked why he had one said, "I don't know, my, my mum just buyed it."

Success Through Collaboration

Knowing your learner, not just how to use the device. Collaboration was the third key theme from this research. In the first instance, this was about a partnership between teacher and student. It was evident from the interviews that success did not merely come from knowing how the RM itself worked. As stated by Miranda, "It's more about knowing your child though, and how to interact with them than use the device." Open communication was key, so that situations where the RM wasn't working well could be solved together. Teachers remarked that they were somewhat unsure of exactly what the student was hearing, and there were times when they weren't sure if the RM was needed or not. Steven recounted that when

the student's peers were talking that "not always does he say, "Can you please put the Roger™ on?" I don't know if (he) doesn't need it, or he's just a bit too shy to interrupt or there's not enough time." If the student does not feel confident enough to voice their needs, or if the teacher does not seek feedback from the student, opportunities for hearing may be missed and problems may go unresolved. William mentioned he often felt "frustrated" by having to connect to the RM, and that the receivers he wore were "annoying" because they were so long. Miranda described how she regularly checked in with her student:

> Just because if um, if she's not looking at me and I'm speaking and I'll just often say to her, "Can you hear me?" and I'll, and she'll just usually give me a thumbs up, so I just check. Um, each morning.

Both teacher and student driven. Claire demonstrated the hand signals that her student uses to communicate to Claire when the RM needs to be turned on, and when she feels it's too loud. A further example of mutual effort from student and teacher is working together to remember to use the device every day. Student George said, "She reminds me to put them on sometimes, when I forget."

Support from a wide variety of sources. When asked about the support they received to work with their student with hearing loss, teachers' responses varied widely. In Steven's case he said he received "zero" information or help at the beginning. "I don't remember hearing any information other than "when you are speaking, (Student) requires you to wear this."" Others had had extensive contact from professionals. Overall, sources of guidance that teachers mentioned included RTDs, AoDCs, ASSIST workers, Special Education Needs Coordinators (SENCOs), school colleagues, interpreters, sign language teachers, VADEC, and the MoE. A key feature was that the help they received and sought out

was from people. While some printed materials were briefly mentioned, what they valued was face-to-face collaboration. Annabelle commented,

> we have a Resource Teacher for the Deaf that comes in twice a week, sometimes three times a week to work with (Student) and also um, the rest of our class too…My RTD, she is absolutely amazing. And our school's getting, getting a lot more supportive, um, with our deaf culture as well…My team leader, she um, she is quite proficient in sign… I had a good hand over from the Year Four teacher too.

Notably, several teachers spoke at length about the help they had received from a parent. Annabelle said that her student's mum was "more than happy to come in" and made sure they had lots of batteries. Miranda described the help she'd received:

> Her mum's amazing, she tells us everything we need to know. If there's a problem she's the first one that I ask. And for example, we had a school camp, um last term and [Name], Mum, came on the camp with us. So that was great… (She) comes to as many things as she can.

A source of support that seemed to have a high impact was having the chance to hear for themselves what the RM was doing. Vanessa described a visit from someone from the MoE:

> She brought the, the headphone that you can hear what you can hear through the Roger™. Um, and even the other teachers and teacher aides that tried it on were like "Woah, this is amazing!" Um, so it just proved to me that he is actually hearing straight, you know he can hear really well with that. Because of course with the hearing aids we're not 100% sure. Um, yeh so that was really beneficial for the class and for the, all the teachers involved.

This experience would have eased some of the anxiety described earlier, with teachers not knowing what their student was hearing.

Overall, most teachers were happy with the amount of support they had received, whether this was a small or large amount. As discussed above this support had come from both 'official sources' in place for teachers in New Zealand such as the RTDs, and other people that were available to them like colleagues and parents. However, not all teachers I spoke to felt that they had received sufficient guidance. Claire, who uses an RM with her Year Four student, informed me,

> the teacher last year got sent the kit. Um, and there were some instructions in there. And that was all that she was given. Um, I have spoken to the parent about it but she didn't know all that much about how to use it… I feel like I do not understand the device properly.

She said that she and the student's previous teacher (in Year Three) had had no contact with the AoDC service and that "it would be really handy to, to hear from the Deaf Association, or have some more support." As previously mentioned, care of students with hearing loss from Year Four onwards is handed over from the AoDCs to the ASSIST service. In this case there has possibly been some miscommunication, perhaps involved with this transition. Claire mentioned she'd heard about the opportunity to attend a course run by the MoE but was not able to attend at that time and hopes to in the future.

When asked what advice they had for a teacher who was about to start using an RM, teachers said they'd encourage making contact with support persons. In reference to ASSIST, Katie recommended, "Email them. Or ring them. Or ask for help. We've had to do it a few times."

The final aspect of collaboration identified was including the other children in the classroom. Most teachers reported that the microphone was used by others, for example children wearing it when presenting to the class or putting it in the centre during group work. Some teachers said that the whole class was learning sign language, for example with a visiting tutor. When speaking with Katie about whether she thought she had done anything to inspire her student's growing self-confidence, she described the impact of including others:

> I think it's been more about using sign language in class to be fair. I think it's the confidence that's come with just being accepted for who he is. Um, that it's ok to be different. He last year, he wouldn't sign at all in class.

Some teachers said they hadn't needed to have a specific conversation to inform their student about what the RM was for or how to use it. Jane spoke about this:

> Initially the very very first time I did, I, we talked about it… cause they would say well, "What's that, that you're wearing?" And, "Why, why does she need things in her ears?" And I said well it's just that she can't hear everything that's going on, so when I speak into the, um, receiver it blocks out all the other noise. And then the kids are like, "Oh cool can I have one?"… As long as the teacher doesn't make a big song and dance about it, the kids aren't gonna care. They're gonna pick up on how you are, and if it's just normal, um they're not going to bother with it.

Student Noah complained that his classmates sometimes wore the microphone the wrong way around, so in this case some education around optimal use would have been useful.

It's Just Part of the Norm

Managed through routines. Now part of the normal daily life of teaching, the children being able to self-manage using the device was something that teachers had worked towards by setting up routines. Claire commented,

> in the morning we have a teacher who's on morning routine, cause we all meet together for a morning hui. She'll just go and take it to that teacher and hand it to them. Um and it, she has it turned on ready to go so they just need to clip it around and then when she's going to her group she'll just walk up to the teacher and they'll automatically know that what she's come up for. And then she'll take it with her. She's very good at managing it herself.

While visiting Jane's classroom, she demonstrated the laminated cards that she used on students' desks, prompting them to get their RM system ready. Teachers talked about how the transmitter charging unit had a 'home' that it always stayed in, and that the microphone would only ever be either being used, or on the charger. Katie described how coloured stickers were used to distinguish between the microphones for two students that both used a Roger Pen™.

Teachers also spoke about the routine strategies they used to get children's attention and that they were usually able to keep their voices at a conversational level. Katie said, "Oh, I don't often raise my voice to them, we have other symbols like we'll call, "Tahi, rua, toru, wha" or clap or there are other ways to get attention rather than yelling over the top of them.

An RM is easy to use. Once their RM routine had been established (e.g. knowing when and where to charge the device), teachers described it as being very simple and easy to use and did not feel burdened or inconvenienced. As Miranda said, "I wear it all the time, and at the end of the day as soon as it's three o'clock I'll go and put it straight on the charging

thing where it will stay until the next morning." They were happy that it was lightweight, non-obtrusive, and had a magnet clasp for easy removal. The only minor suggestions for improvement of the devices were perhaps having a longer or adjustable cord, and a rechargeable option for the Roger™ Focus receivers. Beyond remembering the daily charging, teachers mentioned other small things they had to remember to do, like not having it switched on all the time. As Vanessa said, "Sometimes you've just got to remember to pause it if you're having a conversation with another child or a teacher, um, yeh, you've just got to remember to do that. I'm pretty good now."

Strategies for hearing loss are useful for all children. When asked what steps they took to make sure the student with hearing loss could hear them properly, facing the children and either standing still or sitting when they gave instructions was just part of their daily work and would be beneficial for all children regardless of their hearing ability. A few teachers mentioned strategies beyond this which were specific to the student with hearing loss, like making sure the child sat close to the front, getting the child to repeat back instructions, confirm things with their friends, using sign language, and having a both oral and visual instructions to guide them.

Overall, most teachers had developed confidence using their RM system and would advise new users that they will "get used to" using it too since "it's like a piece of jewellery, sometimes I forget it's there." As Annabelle said, "Don't be scared of it would be my thing, because, yeh, because it seems foreign to begin with but then it'll be fine… it just becomes second nature."

In summary, this chapter has presented the findings of the study in the form of four main themes and a number of sub-themes, supported by quotes from participants. In the following chapter, these findings are discussed with reference to previous research as well as

the implications for students with hearing impairment, their families and educators who support these students in schools.

Discussion

Common Experiences

The first research question set out to determine the common teacher and student experiences of RM use in classrooms. As presented in the results chapter, the common experiences can be summarised by the following themes: A highly valued piece of technology; Attitude affects outcome; Success through collaboration; Just the norm. These themes are discussed below in reference to relevant research.

The value of an RM. The findings of this study add further support to the current consensus that RM technology is an effective tool for helping children hear better in the noisy classroom environment. Both teachers and students commented on the benefit they received.

Because it was seen as such an important and useful device, anxiety around keeping it safe was part of this theme. A recent study into the facilitators and barriers of effective FM system use by Miranda and Brazorotto (2018) found that the most important factor was teacher knowledge. The authors recommended systematic guidance of all school staff in how to use the FM, including the student's main class teacher as well as support staff that work with the child. This, the authors claimed, would decrease non-use or partial use of the device due to lack of understanding of real benefit and fear of handling unfamiliar technology (Miranda & Brazorotto, 2018).

Teacher and student attitudes. The present study found that student participants were limited in their ability to talk about their own hearing loss and needs, but were able to implement self-management skills. This indicates developing self-determination. Luckner and Sebald (2013, p. 377) defined self-determination as "a combination of attitudes, knowledge, and skills that enables individuals to make choices and engage in goal-directed, self-regulated behaviour". These are developed over time through repeated opportunities and

with appropriate support from educators and parents, and are influenced by the child's personality characteristics (Cho, Wehmeyer, & Kingston, 2012; Ormrod, 2011; Shogren, 2013). Part of the ongoing relationship between an audiologist and the family of a child with hearing loss is counselling around cause, effects and appropriate management strategies. When a child is diagnosed with hearing loss from a young age, for example at birth, this conversation is with the parents. As the child grows older, an audiologist can guide the young person to take more responsibility in managing their own devices and to make choices. George mentioned the thing he liked most about his devices were that they were blue. Small details such as allowing a child to pick the colour or add stickers may encourage a more positive attitude and a sense of ownership and control over the situation, therefore leading to more use and better outcomes. As well as this choice and decision making aspect, Luckner and Sebald (2013) identified five further components of self-determination: self-awareness/self-knowledge; goal setting/attainment; problem solving; self-regulation/self-management; and self-advocacy. Luckner and Sebald's (2013) essay recommends age appropriate structured experiences to develop self-determination, for example between two and five years old children can learn to look after their own HAT. According to the authors, at age six years students can begin to understand their hearing loss, and between nine and eleven they can focus on explaining their hearing loss to others.

Self-advocacy, one component of self-determination, is defined as a person's ability to identify the specific types of support that they need to succeed, and to communicate that information to others as needed (e.g. to teachers and employers) (Friend & Bursuck, 2012). This may take one of two forms. Personal self-advocacy is focused on the individual, while group self-advocacy is aimed at promoting social justice for the group that an individual belongs to e.g. the deaf community (Kozminsky, 2004; Michael & Zidan, 2018; Zegar & Baumann, 2012). In their research Michael and Zidan compared the self-advocacy of students

with hearing loss and students with normal hearing. While the authors found no significant difference in self-advocacy between participant groups, they did measure lower self-esteem in those with hearing loss (Michael & Zidan, 2018). They also found that students' language abilities were related to self-advocacy components, and therefore interventions aimed at enhancing self-advocacy "should focus on intensifying their self-esteem as well as their syntactic and pragmatic abilities" (Michael & Zidan, 2018, p. 125).

As seen with one student in the present study, some children may be reluctant to use an RM because it identifies them as different from their 'normal' peers. HAT is somewhat of a double-edged sword in that it can be both a tool to achieve independence but also a visible sign of disability (Scherer, 2002). If it is seen positively and as a useful tool to achieve a desired activity, it is more likely to be used (Rekkedal, 2012). Conversely, if it is seen as a sign of disability its use may reinforce stigma and lead to the avoidance of activities and therefore social and physical isolation (Polgar, 2010; Rekkedal, 2012). This may be made worse if there are few (or no) other children in their school who also use an RM or other hearing technology. For these children who struggle with self-esteem, attending KIT (Keep in Touch) days where they can connect with other children with hearing loss may be a helpful tool. One of the children in this study mentioned their attendance at such an event. Research suggests that identifying within a group can provide a sense of belonging and counteract negative impacts of prejudice and discrimination (Bat-Chava, 1993; Bat-Chava, 1994, 2000; Crocker & Major, 1989; Phinney, 1991). Several researchers note that individuals who identify as part of the deaf community and spend a significant amount of time with these peers often have positive self-worth (Bat-Chava, 1994; Olney & Brockelman, 2003; Schirmer, 2001).

This study identified teacher attitude to be a significant theme in RM success. Key factors that lead to more successful use include: the extent of resilience in the face of

challenges using the RM; the willingness of a teacher to be an advocate for their student; and the effort a teacher puts in to establish the routines for RM use. These positive behaviours will only be built on a fundamental understanding of how hearing loss affects the child and the huge potential a child has despite their hearing difficulties.

In recent years there has been a shift in our society's thinking about disability. The traditional medical model views it as dysfunction of the human body, a deficiency inherent in the individual (Eriks-Brophy & Whittingham, 2013). Focus has now moved away from this emphasis on the characteristics and abilities of the person, and towards variables of the social and physical environment that impact the person (WHO, 2001). In the general context of children with disability, one must consider a number of interrelated external factors in their learning environment. The teacher's (and wider school's) attitude towards disability and the inclusion of students with disability, the level of expectation for a child with disability, the resources that are allocated, the actions taken to ensure a child can take part in school life, and the knowledge of the teacher in how a child is affected and how to modify the curriculum appropriately for differing needs, all have the potential for impact (Antia et al., 2011; Borders, Barnett, & Bauer, 2010; Marschark & Spencer, 2010; Marschark, Spencer, Adams, & Sapere, 2011; Mitchell & Karchmer, 2011; Slobodzian, 2011). The roles of audiologists and teachers in developing this knowledge, and positive attitudes, are reviewed later in this research as part of the clinical and classroom implications section.

Working together. As discussed earlier, mutual understanding between teacher and student is crucial for open communication around the experiences of the child with hearing loss in the classroom (Brackett, 1997). While all the teachers interviewed for this thesis had an understanding of this need, this was achieved practically to varying degrees of success.

The variety of sources, and the variation in the amount of help that the teachers received was a key feature in the findings of this study. On top of the governmental help such as the AoDC and RTD services, some teachers received extensive support from the parent(s) of the student with hearing loss. It is widely accepted in today's society that parental involvement in a child's education is a significant factor in academic success (Harris & Goodall, 2008). For children with and without special needs, parental involvement is encouraged and can lead to higher achievement (regardless of other factors such as socioeconomic status and parent's education), positive attitudes, and improved behaviour etc. (Henderson & Berla, 1994). For children with hearing loss, parents can offer the teacher and school their valuable insight into the child's needs, help with specialist knowledge such as how to work equipment, or support the teacher in including the student e.g. accompanying them on field trips. During investigation into parental involvement in the care and intervention of children with hearing loss, Erbasi, Scarinci, Hickson and Ching (2018, p. S20) identified the theme entitled 'Parents act as "case managers"'. This involved "arranging and attending appointments/meetings, evaluating services, communicating with various professionals, educating others, advocating on behalf of the child, and empowering the child to self-manage his or her hearing loss" (Erbasi et al., 2018, p. S20). Audiologists should acknowledge the many roles that parents and caregivers take on at home and at school, and ensure they are well supported. This is echoed in the consensus statement on best practices for family-centred care by Moeller, Carr, Seaver, Stredler-Brown and Holzinger (2013). They state that service providers should work with families, in order to "enhance their confidence and competence in fostering their children's development" (Moeller et al., 2013, p. 432).

Another area of family-centred care identified by Moeller et al. (2013), is the need for multidisciplinary collaboration and communication. Professionals working together for a child with hearing loss may include audiologists, RTDs, AoDCs, speech-language

pathologists, ENTs etc. The situations of some teachers in this study reflect this family-centred model, where they felt like they were a part of a network of support and knew who to contact for help. For others this does not seem to have been achieved yet, as there was some lack of communication or lack of knowledge of who they could get in touch with (irrespective of whether or not the teacher felt they needed to).

Daily routine. All of the teachers in this study mentioned the routines they had around using the RM system and keeping it charged. Only one teacher however commented on the routine of daily checks to confirm the RM was working. This relates back to the need for communication between teacher and student. Some students may not feel confident enough to tell their teacher when they can't hear, making these daily checks a crucial teacher-driven part of RM success. This process can be demonstrated by an AoDC or RTD, and will ensure maximum benefit is obtained from using the device.

It is also important for teachers to know that, being an electronic product, at some point there may be problems with its functioning. This may not be because they are doing anything wrong, but could be due to use over a long period of time as all electrical products have a limited lifespan. Some of the teachers and children interviewed mentioned ongoing problems with connection or the device holding charge, and a period of frustration where they did not know why it wasn't working. Having a support network with someone who is familiar with an RM will help teachers recognise when the product needs to be serviced by the manufacturer or replaced, as it is not likely that the manufacturer themselves will advise the user what to look for.

Further Support Needed

The second research question set out to determine what types of extra support teachers felt might be needed for effective RM system use in classrooms. This study found

that the majority of Canterbury teachers interviewed were happy with the amount of support they received to use their RM system. In some cases, this was because support had come from many sources, and for others they felt self-sufficient in learning how to use it. As seen in this study, e.g. teacher Claire, there are still those teachers who feel like they need help. For teachers who have a limited support system around them (e.g. no colleagues with previous RM experience, no parent help etc.), and those that are not able to travel to attend courses, having a reliable online source of information of how to use an RM and strategies to get the most benefit from it would be extremely valuable. As Jane said, "I think if you'd never used it before, it would be good to have just probably like a one page." The learning modules currently being developed by the Deaf Education Centres in New Zealand are one such resource. Hopefully they will not only provide useful information on how to use an RM effectively but also give teachers the encouragement and contact details to seek further help if needed, to make those valuable in-person connections. This is especially important for those teachers who, for whatever reason, have not spoken to an AoDC, RTD or ASSIST worker, like Claire. Research around these resources could examine the effectiveness of these modules in increasing teacher knowledge of RM use, and their effect on teacher perceptions and level of confidence.

Classroom Implications

The main point for teachers to consider from this thesis is that there are a group of professionals able and willing to help with any concerns a teacher may have with using their RM. If a teacher feels they need more support to be successful the researcher urges them to initiate contact with their local AoDC, RTD or ASSIST service. Teachers in management e.g. principals, may want to talk with their colleagues who use RMs to find out how confident they are in using it, and consider the value of offering professional development opportunities to those in need. Examples of this may include supporting the teacher to make contact with a

service (e.g. local AoDC), sending them for a day course such as those available through the MoE (as mentioned by participants), or connecting them with a colleague more experienced in using the technology.

Clinical Implications

In terms of RM fitting, all of the participants interviewed used a Phonak Roger Pen™. The results of this study show that this product can be used successfully with paediatric clients. Phonak does however also offer a specialised paediatric product called the Roger™ Touchscreen which audiologists may want to consider instead for their clients due to the presence of extra features like the ability to link multiple devices but give voice priority to one main speaker (Phonak, n.d.-b).

Considering the frequency with which teachers mentioned that they received help from a parent, this research reveals the importance of audiologists monitoring and supporting parents' needs in understanding their child's hearing loss and being an advocate for them. This research also highlights the requirement for audiologists to monitor the needs of their paediatric clients in terms of age appropriate self-determination skills, and to work with the family to support this personal growth. A student who has knowledge of their own hearing loss, the confidence to explain their needs, and the ability to take an active part in the management of their device will be better placed for success with their RM; it is not just down to the actions of the teacher. Luckner and Sebald (2013) suggest to be wary that families may not necessarily recognise or value self-determination in the same way depending on their cultural context and therefore adaptation of the audiologist's approach may be necessary. This continued monitoring of progress is a further aspect of family-centred care described by Moeller et al. (2013).

As discussed in the present study, the use of an RM system in the classroom can involve a variety of challenges, especially to begin with as the teacher and student learn how to manage the device together. Ensuring that the RM is working properly and that the output is at an appropriate volume level for the child is a crucial step for the audiologist to maximise the chance of success. As stated by McCreery (2014), some professionals may feel uncomfortable with the electroacoustic verification of RM systems, possibly due to lack of familiarity or knowledge of the process. McCreery (2014) recommends using the HAT guidelines offered by the American Academy of Audiology as a step by step guide to verification. For New Zealand audiologists, as previously mentioned, the verification process is outlined in Appendix 19 of the NHSEIP protocols document (MoH, 2016).

Study Limitations

Recruitment for this study was challenging. Teachers are exceptionally busy, especially towards the end of the school term, and finding a mutually available time for interviews was difficult at times. Several teachers who expressed initial interest later declined due to time constraints and workload pressure.

The small sample size of this study means that the findings may not be reflected in the wider teacher and student population of Canterbury. As noted by P. Peryman however, the student and teacher comments are indeed consistent with those heard in clinic and recorded on file at VADEC (personal communication, November 28, 2019). Further, the results may not be representative of the experiences of others nationwide. The latter is especially true since Christchurch locals have the advantage of VADEC being close and therefore are likely to have more face-to-face contact with people that can support them through challenges.

There may be differences in the success of RM use with different types of hearing technology e.g. cochlear implants vs hearing aids, or different types of classrooms (single-

cell vs. large ILEs). However, the sample size of this study was too small to investigate this possibility.

This study is potentially biased towards those who had positive experiences in terms of the participants who responded to my advertisements. Those who were successfully using RMs may have been more willing to come forward and share their thoughts, and teachers that were struggling more may not have wanted to reveal these difficulties. There may also have been bias in the selection of students who were put forward by the AoDCs or RTDs.

As previously described, the researcher informed participants of their teaching background, but avoided sharing personal experiences and opinions of RM systems before the interviews were conducted. Knowing that they were speaking with a fellow teacher who could empathise with their situation may have resulted in the participants feeling more at ease to share their concerns. On the other hand, it may have led to teachers being less likely to open up if they were concerned about being judged by a colleague.

Not interviewing a child in front of their teacher, as mentioned earlier, was an important part of the study design to encourage the child to speak openly and honestly about their experiences. It is still possible that the presence of the interview supervisor influenced what each child felt comfortable sharing, depending on the nature of their relationship with the child. Removing this influence was not possible due to the health and safety requirements that students be accompanied at all times.

When speaking with the students, the researcher’s intention was to conduct interviews that were longer than were actually achieved. Although having a familiar person there from their school was intended to ease any anxiety, the children were at times nervous to speak. The children were likely eager to please and may have also been reluctant to share their negative experiences. If there was more time for this research then meeting the children more

than just once may have made them more comfortable and facilitated longer, richer discussions. Visiting the school more times may have also afforded the opportunity to view the RM being used in a real classroom situation.

Future Research

Self-advocacy in children with hearing loss is an issue raised by this thesis that warrants further research. As mentioned by Michael and Zidan (2018), only a few studies have been completed on this topic. Recently, foundational research was presented on the development and evaluation of a self-advocacy assessment tool for pre-school age children, which may provide a basis for a similar tool to be developed for primary aged students (Moffatt, 2016).

Several authors have noted that older students tend to use assistive listening devices less than younger students (Kent & Smith, 2006; Odelius, 2010; Wennergren, 2008). Since this research involved participants only up to Year Six, a follow-up to this project could be an investigation into experiences of teenagers using RM systems, Year Seven and above, and what factors may be influencing decreased use and changing attitudes towards HAT in this age group.

Conclusion

In conclusion, teachers and students in this study reported the RM as an extremely useful piece of technology that they were able to easily use on a daily basis to facilitate communication in the classroom. Successful use came from the attitudes and efforts of the teacher, the student, and a surrounding network of support persons. Teachers are urged to seek out further support as needed, possibly using the VADEC teacher education modules, while audiologists are reminded of the need to continually support both the child and parents in building their understanding of hearing loss, and advocacy skills.

This study supports the current consensus that RM systems, when used well, are an effective classroom tool for children with hearing loss. They are not, however, a panacea. Even after obtaining such a device, there remains a continuing need to identify and monitor the technologies and strategies that best support students with hearing loss to reach their learning potential. By maximally supporting the development of a child's language and communication, social and academic skills, the teaching and audiological communities can help deaf or hard of hearing children live meaningful and fulfilling lives.

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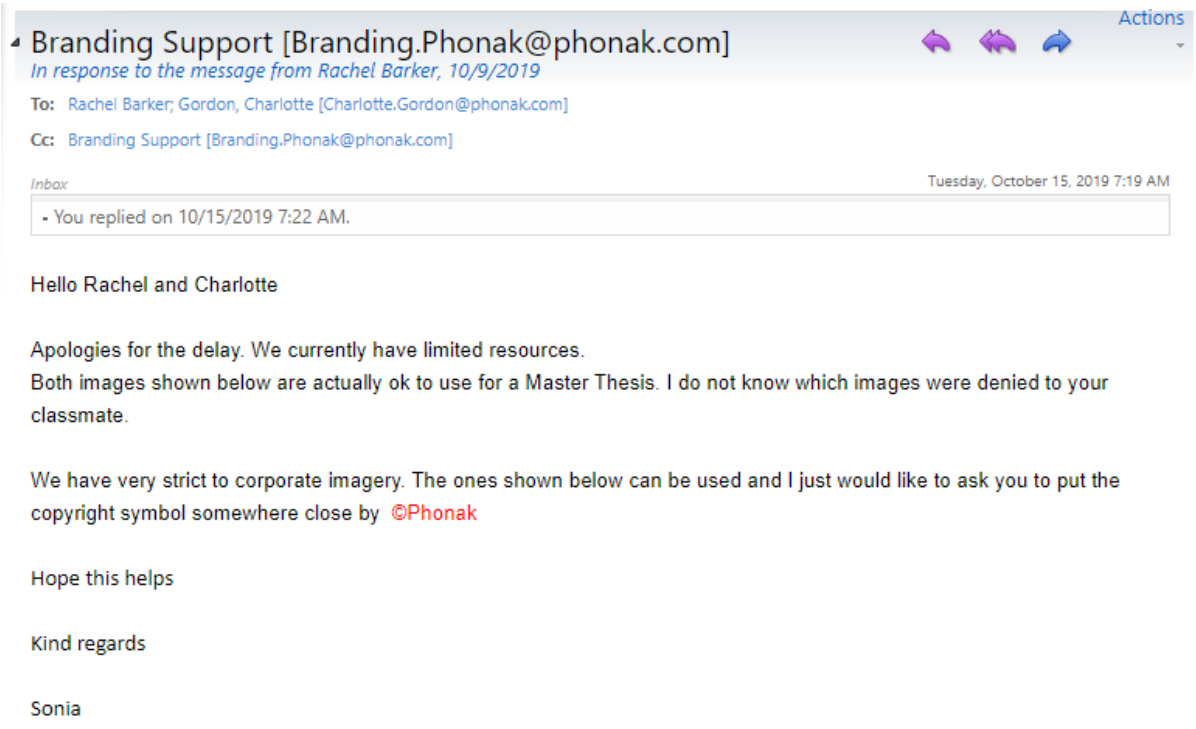
Appendix A

Consent for use of Phonak Images (Figures 1 and 2)



Actions

Branding Support [Branding.Phonak@phonak.com]

In response to the message from Rachel Barker, 10/9/2019

To: Rachel Barker; Gordon, Charlotte [Charlotte.Gordon@phonak.com]

Cc: Branding Support [Branding.Phonak@phonak.com]

Inbox Tuesday, October 15, 2019 7:19 AM

- You replied on 10/15/2019 7:22 AM.

Hello Rachel and Charlotte

Apologies for the delay. We currently have limited resources.
Both images shown below are actually ok to use for a Master Thesis. I do not know which images were denied to your classmate.

We have very strict to corporate imagery. The ones shown below can be used and I just would like to ask you to put the copyright symbol somewhere close by ©Phonak

Hope this helps

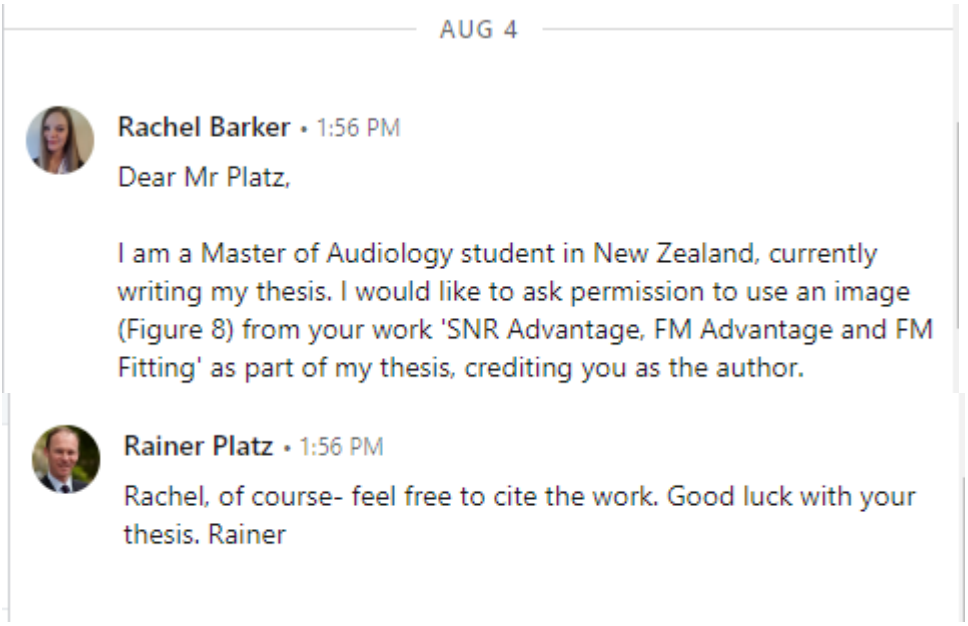
Kind regards

Sonia

Appendix B

Consent for use of FM Advantage Image (Figure 3)

Author contacted through LinkedIn, as shown below:



Appendix C

Ethics Approval Letter

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: 2019/27/ERHEC

11 June 2019

Rachel Elizabeth Barker
Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Rachel

Thank you for providing the revised documents in support of your application to the Educational Research Human Ethics Committee. I am very pleased to inform you that your research proposal "Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms" has been granted ethical approval.

Please note that this approval is subject to the incorporation of the amendments you have provided in your emails of 6th and 10th June 2019.

Should circumstances relevant to this current application change you are required to reapply for ethical approval.

If you have any questions regarding this approval, please let me know.

We wish you well for your research.

Yours sincerely

pp R. Robinson

Dr Patrick Shepherd
Chair
Educational Research Human Ethics Committee

Please note that ethical approval relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval by the Educational Research Human Ethics Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research.

F E S

Appendix D

Teacher Interview Questions

Intro Questions:

- How much teaching experience have you had?
- Is your current classroom open plan, or single cell?
- How would you describe the typical levels of noise in your current classroom?
- Do you address your class with a raised voice or normal voice effort?

Your Learner:

- What are the hearing and communication needs of the student you're using the RM with now?
- Apart from using the RM, what else do you do to make sure the student can hear you?

RM Questions:

- How much experience do you have using an RM with any student?
- How long have you used RM specifically with this child?
- Do you feel that using the RM benefits the student? How do you know?
- What type of RM are you currently using?
- How do you wear it?
- Do you typically move around while speaking to the class when using the RM microphone or do you stand still or sit?
- Does anyone else use the microphone apart from you?
- How much information and support did you receive before beginning to use an RM?
- Was this enough, or did you feel like more would have been helpful?
- What are some things you know about helping the student to benefit the most from their

RM?

- What are some things you know about taking good care of the RM?

- What are some challenges you personally have experienced while using the RM? What (if anything) did you do to overcome this challenge?

- What difficulties has your student experienced while using the RM? Have they raised this concern with you, or was that something you noticed yourself?

- How confident do you feel using an RM?

Future Questions

- What advice might you give other teachers who are about to start using an RM?

- What (if anything) could be improved about the RM?

Appendix E

Student Interview Questions

- Tell me about your RM, how does it work?
- Do you know why you use an RM?
- When does your RM help you to hear better?
- How does using an RM make you feel?
- What do you like about your RM?
- What do you not like about your RM?
- When does it not work well?
- Are there any times you don’t like wearing your RM? When? Why?
- What does your teacher do to help you use your RM?
- What could a teacher do to help you hear even better with your RM?

Appendix F

Facebook Recruitment - Teacher information letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Teachers

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been approached to take part in this study because you responded to an advertisement on the 'NZ Teachers (Primary)' Facebook group. You have identified yourself as a teacher who currently uses an RM system in a Canterbury classroom, and you are interested in taking part. You have volunteered your contact details in order to receive this information sheet.

If you choose to take part in this study, you will first be required to receive permission from your school principal via a signed consent form. At a mutually agreed upon time, I will then visit your school to conduct an interview of no longer than one-hour duration. This will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by you. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences you share in the interview will be compared with those of other participants, and common themes identified.

As the title states, this project also involves interviewing children who use RM systems. It is NOT a requirement that a student from your school also be interviewed in order for you to participate. However, information sheets and consent forms for parents will be made available at your interview time if you believe a student's parents may be interested in letting their child participate. I will then return to the school on another date at a time and place convenient for you, your principal, the student and their parent/caregiver. On that day the purpose of the interview will be explained in simple language to the

student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will proceed to conduct a short interview (approximately 15 minutes) with the student. Please note, it is a requirement that another adult (e.g. a teacher aide or another teacher) accompany the student for this interview with me, for student safety and so that the student may speak freely about their experience of using the RM with you. When organising the date and time of the student interview, I will ask you to please confirm that you have organised a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following your interview, no further action will be required except helping me obtain parent permission if a student interview was to be arranged.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 5th August 2019, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or in person to me before the interview.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I have received permission from my school's principal to take part in the research.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that I am required to organise a supervisor if a student interview is to take place.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name:_____

School:_____

Signed:_____ Date:_____

Email address *(for report of findings, if applicable)*:

_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return a hard-copy in person before the start of the interview.

Appendix G

Facebook Recruitment - Principal information letter and consent form

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Principals

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been approached because one of your teachers, who currently uses a remote microphone system in their classroom, has expressed an interest in participating in this research. In order for them to take part, I first require permission from their school principal via a signed consent form.

If permission is granted, at a mutually agreed upon time, I will visit your school to conduct an interview with the teacher in question. This will take no longer than one hour to complete and will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by the teacher. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences they share in the interview will be compared with those of other participants, and common themes identified.

As the title states, this project also involves interviewing children who use RM systems. It is NOT a requirement that a student from your school also be interviewed in order for the teacher to participate. However, with your permission, information sheets and consent forms for parents will be made available to the teacher at their interview time if a student's parents may be interested in letting their child participate. I will then return to the school on another date at a time and place convenient for you, the teacher, the student and their parent/caregiver. On that day the purpose of the interview will be explained in simple language to

the student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will proceed to conduct a short interview (approximately 15 minutes) with the student. It is a requirement that another adult (e.g. a teacher aide or teacher, but not the student's teacher) be present for this interview to take place with me. This is so that the student may speak freely about their experience of using the RM with their teacher. When organising the date and time of the student interview, the teacher will be asked to confirm a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following the teacher's interview, no further action will be required except helping me obtain parent permission if a student interview was to be arranged. Following the student interview, no further action will be required.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Teacher and student participation are voluntary, and they have the right to withdraw at any stage without penalty. You have the right to withdraw your permission for the teacher and/or student's participation at any stage without penalty. The teacher and/or student may ask for their raw data (audio file and transcript) to be returned to them or destroyed at any point. If you withdraw your permission, I will remove information relating to your teacher and/or student. However, once analysis of raw data starts on 5th August 2019, it will become increasingly difficult to remove the influence of the teacher's or student's data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about giving permission for teacher and/or student participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for the teacher and/or student to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or in person to the me before the interview(s).

Rachel Elizabeth Barke

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Principals

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of the teacher if they agree to take part in the research.
- ☐ I understand what is required of the student if they agree to take part in the research.
- ☐ I understand that it is a requirement for all student interviews that a member of staff is present for the duration of the meeting (not the child's classroom teacher), and that the teacher will organise for a suitable person to be present.

Please tick or delete as appropriate:

- ☐ I give permission for the **teacher** I employ, as named below, to take part in the research.
- ☐ I give permission for the **student** at my school, as named below, to take part in the research on the condition that **parental consent and student assent** is obtained. I give permission for the child's teacher to pass on the parent information sheet and consent form in order for the researcher (Rachel Elizabeth Barker) to obtain this consent.
- ☐ I understand that teacher and student participation is voluntary, and I may withdraw either permission at any time without penalty. Withdrawal of permission will also include the withdrawal of any information that I, the teacher or the student have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I, the teacher, or the student provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for

further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

☐ I would like a summary of the results of the project.

Principal's Name: _____

School:_____

Email address *(for report of findings, if applicable)*:

_____

By signing below, **I give permission for my employee** _____(teacher's full name) to participate in this research project.

Signed:_____Date:_____

By signing below, **I give permission for my student** _____(student's full name) to participate in this research project, on the condition that parental consent and student assent is obtained.

Signed:_____Date:_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return a hard-copy in person before the start of the interview.

Appendix H

Facebook Recruitment – Parent/caregiver letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Parent/Caregiver

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been approached because your child currently uses an RM system in their classroom. This device consists of a microphone worn by the teacher that transmits their voice directly to an earpiece worn by the child. It helps your child to hear their teacher's voice more clearly. With your permission, I would like interview your son/daughter to ask them about their experiences of using their RM system.

Permission has been granted by your child's principal for such an interview to take place, on the condition that parent/caregiver consent and student assent is obtained. If you agree, I will visit your child's school at a time and place convenient for you, their principal, and their teacher. On the day, the purpose of the interview will be explained in simple language to your child by showing them an information slideshow. They will say whether or not they agree to talk with me and will indicate this on an assent form. If they are happy to proceed, a short interview of approximately 15 minutes will commence. Your child will be accompanied by an adult for the duration of the meeting (e.g. a teacher other than their own, or a teacher aide). This adult will be arranged by your child's teacher and is required to sign a confidentiality agreement before supervising the interview.

The discussion with your child will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by your child. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences each student shares in their interview will be compared with those of other participants, and common themes identified.

In order to confirm your child's eligibility for this study, the researcher Rachel Barker may need to contact a member of the professional team working with your child e.g. their audiologist, AoDC (Adviser on Deaf Children), RTD (Resource Teacher of the Deaf), or Assist worker. By signing the attached consent form, and providing contact details, you give permission for Rachel to discuss your child's hearing needs and case history with any of these professionals, and to include this information in the study as needed.

To acknowledge their participation all students interviewed will receive a sticker or small toy.

Following the student interview, no further action will be required by the student or their parent/caregiver.

Participation is voluntary. You and your child have the right to withdraw at any stage without penalty. You may ask for your child's raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to your child. However, once analysis of raw data starts on 5th August 2019, it will become increasingly difficult to remove the influence of their data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project. Please also feel free to discuss your child's participation in this study with their principal and/or classroom teacher if you wish.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for your child to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or as a hard-copy to your child's teacher so that it may be presented to me prior to your child's interview.

Rachel Elizabeth Barker

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Parent/Caregiver

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I am aware that my child's school principal has given permission for my child to take part in the research.
- ☐ I understand what is required of my child if I agree for them to take part in the research.
- ☐ I understand that other than giving this permission, there is no requirement for me to take any further action related to this research.
- ☐ I understand that my child will at all times be accompanied by a member of school staff, (to be organised by my child's teacher), and not left alone with the researcher Rachel Elizabeth Barker.
- ☐ I understand that student participation is voluntary and I may withdraw my permission at any time without penalty. Withdrawal of participation will also include the withdrawal of any information my child has provided should this remain practically achievable.
- ☐ I understand that the researcher Rachel Barker may need to contact members of the professional team working with my child e.g. their audiologist, AoDC (Adviser on Deaf Children), RTD (Resource Teacher of the Deaf), or Assist worker. I give permission for this contact, for Rachel to discuss my child's hearing needs and case history with them, and for this information to be included in the study as necessary.
- ☐ I understand that any information or opinions my child provides will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.

☐ By signing below, I give permission for my child to participate in this research project, on the condition that they themselves agree to talk with the researcher Rachel Elizabeth Barker.

Parent/Caregiver Name: _____ Child's Name: _____

If known, names of hearing professionals that work with my child e.g. Audiologist (at Triton Hearing), AoDC, RTD, Assist worker etc.:

_____

_____

Parent/Caregiver Signature: _____ Date: _____

Email address *(for report of findings, if applicable)*:

_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return a hard-copy to your child's teacher so that it may be presented to me prior to the interview.

Appendix I

AoDC Recruitment - Teacher information letter and consent form

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Teachers

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

A parent of a child in your class has been given information about this study from their Adviser on Deaf Children (AoDC). The parent has consented to their child taking part. They have also given permission for me to contact their school principal and classroom teacher, to see if their teacher is interested in also being interviewed. Although parent consent has been given, I would like to emphasize that you are not obligated to be part of the study if you do not wish to be, and your principal is not obligated to give permission.

If you would like to be involved, at a mutually agreed upon time, I will visit your school to conduct an interview with you of no longer than one-hour duration. This will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by you. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences you share in the interview will be compared with those of other participants, and common themes identified.

I will then return to the school for the student interview, on another date at a time and place convenient for you, your principal, the student and their parent/caregiver. On that day the purpose of the interview will be

explained in simple language to the student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will proceed to conduct a short interview (approximately 15 minutes) with the student. Please note, it is a requirement that another adult (e.g. a teacher aide or another teacher) accompany the student for this interview with me, for student safety and so that the student may speak freely about their experience of using the RM with you. When organising the date and time of the student interview, I will ask you to please confirm that you have organised a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following your interview, no further action will be required except organising a time and supervisor for the student interview.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or in person to me before the interview.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that parent/caregiver consent has already been obtained for the student interview.
- ☐ I understand that I am not obligated to participate even though parent/caregiver consent has been given for the student to.
- ☐ I understand that permission from my school principal is required for both teacher and student interviews, and that they have received a similar information and consent document to sign for this purpose.
- ☐ I understand that I am required to organise a supervisor if a student interview is to take place.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.

☐ By signing below, I agree to participate in this research project.

Name:_____ School:_____

Signed:_____ Date:_____

Email address *(for report of findings, if applicable)*:

_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return a hard-copy in person before the start of the interview.

Appendix J

AoDC Recruitment - Principal information letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Principals

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been approached because a parent of one of your students has expressed an interest in their child participating in this research. They have been told about this study by the Adviser on Deaf Children (AoDC) that works with their child. I am interested in interviewing both this student and their teacher, and would like to request your permission.

Although parent consent has been given, I would like to emphasize that you are not obligated to give permission for teacher and student interviews. The teacher in question is also not obligated to take part in the research.

If permission is granted, at a mutually agreed upon time, I will visit your school to conduct an interview with the teacher in question. This will take no longer than one hour to complete and will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by the teacher. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences they share in the interview will be compared with those of other participants, and common themes identified.

I will then return to the school for the student interview on another date, at a time and place convenient for you, the teacher, the student and their parent/caregiver. On that day the purpose of the interview will be explained in simple language to the student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will proceed to conduct a short interview (approximately 15 minutes) with the student. It is a requirement that another adult (e.g. a teacher aide or teacher, but not the student's teacher) be present for this interview to

take place with me. This is so that the student may speak freely about their experience of using the RM with their teacher. When organising the date and time of the student interview, the teacher will be asked to confirm a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following the teacher's interview, no further action will be required except organising the time and supervisor for the student interview. Following the student interview, no further action will be required.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Teacher and student participation are voluntary, and they have the right to withdraw at any stage without penalty. You have the right to withdraw your permission for the teacher and/or student's participation at any stage without penalty. The teacher and/or student may ask for their raw data (audio file and transcript) to be returned to them or destroyed at any point. If you withdraw your permission, I will remove information relating to your teacher and/or student. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of the teacher's or student's data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about giving permission for teacher and/or student participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for the teacher and/or student to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or in person to the me before the interview(s).

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Principals

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of the teacher if they agree to take part in the research.
- ☐ I understand what is required of the student if they agree to take part in the research.
- ☐ I understand that it is a requirement for all student interviews that a member of staff is present for the duration of the meeting (not the child's classroom teacher), and that the teacher will organise for a suitable person to be present.
- ☐ I understand that parent/caregiver consent has already been obtained for the student interview.
- ☐ I understand that I am not obligated to give permission, and the teacher is not obligated to participate, even though parent/caregiver consent has been given.

Please tick or delete as appropriate:

- ☐ I give permission for the **teacher** I employ, as named below, to take part in the research.
- ☐ I give permission for the **student** at my school, as named below, to take part in the research.

- ☐ I understand that teacher and student participation is voluntary, and I may withdraw either permission at any time without penalty. Withdrawal of permission will also include the withdrawal of any information that I, the teacher or the student have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I, the teacher, or the student provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

☐ I would like a summary of the results of the project.

Principal's Name:_____ School:_____

Email address *(for report of findings, if applicable)*:

_____

By signing below, **I give permission for my employee** _____(teacher's full name) to participate in this research project.

Signed:_____Date:_____

By signing below, **I give permission for my student** _____(student's full name) to participate in this research project, on the condition that student assent is obtained, and with the knowledge that parent/caregiver consent has already been obtained.

Signed:_____Date:_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return a hard-copy in person before the start of the interview.

Appendix K

AoDC Recruitment – Parent/caregiver letter and consent form

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Parent/Caregiver

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been given this letter by the Adviser on Deaf Children (AoDC) who works with your child because they think you might be interested in your child taking part. Permission to distribute this information to AoDCs has been granted by Paul Peryman and Bernadette Mulcahy-Bouwman at Van Asch Deaf Education Centre.

Your child currently uses an RM system in their classroom. This device consists of a microphone worn by the teacher that transmits their voice directly to an earpiece worn by the child. It helps your child to hear their teacher's voice more clearly. With your permission, I would like interview your son/daughter and their teacher to ask them about their experiences of using their RM system.

If you grant permission for me to interview your child by signing the attached consent form, I will then contact their school principal and teacher to ask if they are interested in being involved with the study. They will also be given information sheets and asked to sign consent forms. Teacher and student interviews will only be organised if all parties consent.

If agreed upon, I will visit your child's school at a time and place convenient for you, their principal, and their teacher. On the day, the purpose of the interview will be explained in simple language to your child by showing them an information slideshow. They will say whether or not they agree to talk with me and will indicate this on an assent form. If they are happy to proceed, a short interview of approximately 15 minutes will commence. Your child will be accompanied by an adult for the duration of the meeting (e.g. a teacher other than their own, or a teacher aide). This adult will be arranged by your child's teacher and is required to sign a confidentiality agreement before supervising the interview.

The discussion with your child will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by your child. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences each student shares in their interview will be compared with those of other participants, and common themes identified.

In order to confirm your child's eligibility for this study, the researcher Rachel Barker may need to contact a member of the professional team working with your child e.g. their audiologist, Adviser on Deaf Children (AoDC), or RTD (Resource Teacher of the Deaf). By signing the attached consent form, and providing contact details, you give permission for Rachel to discuss your child's hearing needs and case history with any of these professionals, and to include this information in the study as needed.

To acknowledge their participation all students interviewed will receive a sticker or small toy.

Following the student interview, no further action will be required by the student or their parent/caregiver.

Participation is voluntary. You and your child have the right to withdraw at any stage without penalty. You may ask for your child's raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to your child. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of their data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project. Please also feel free to discuss your child's participation in this study with their principal and/or classroom teacher if you wish.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for your child to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or as a hard-copy to your child's teacher so that it may be presented to me prior to your child's interview.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Parent/Caregiver

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of my child if I agree for them to take part in the research.
- ☐ **I am aware that if I give permission for my child to be involved, my child's school principal and teacher will then be contacted by Rachel Elizabeth Barker and asked if they are interested in taking part.**
- ☐ I am aware that interviews will only take place if consent is granted by all parties – a parent/caregiver, the principal, and the teacher. This may mean that my child is not interviewed.
- ☐ I understand that other than giving this permission, there is no requirement for me to take any further action related to this research.
- ☐ I understand that my child will at all times be accompanied by a member of school staff, (to be organised by my child's teacher), and not left alone with the researcher Rachel Elizabeth Barker.
- ☐ I understand that student participation is voluntary and I may withdraw my permission at any time without penalty. Withdrawal of participation will also include the withdrawal of any information my child has provided should this remain practically achievable.
- ☐ I understand that the researcher Rachel Barker may need to contact members of the professional team working with my child e.g. their audiologist, AoDC (Adviser on Deaf Children), RTD (Resource Teacher of the Deaf), or Assist worker. I give permission for this contact, for Rachel to discuss my child's hearing needs and case history with them, and for this information to be included in the study as necessary.
- ☐ I understand that any information or opinions my child provides will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.

☐ By signing below, I give permission for my child to participate in this research project, on the condition that they themselves agree to talk with the researcher Rachel Elizabeth Barker.

Parent/Caregiver Name: _____ Child's Name: _____

Child's School: _____

If known, names of hearing professionals that work with my child e.g. Audiologist (at Triton Hearing), AoDC, RTD etc.:

_____

_____

Parent/Caregiver Signature: _____ Date: _____

Email address *(for report of findings, if applicable)*:

_____

Parent/caregiver, please sign and send electronically to rachel.barker@pg.canterbury.ac.nz.

No further action is needed.

Appendix L

RTD Recruitment – Teacher information letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Teachers

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Canterbury who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

A parent of a child in your class has been given information about this study from their Resource Teacher of the Deaf (RTD). The parent has consented to their child taking part. They have also given permission for me to contact their school principal and classroom teacher, to see if their teacher is interested in also being interviewed. Although parent consent has been given, I would like to emphasize that you are not obligated to be part of the study if you do not wish to be, and your principal is not obligated to give permission.

If you would like to be involved, at a mutually agreed upon time, I will visit your school to conduct an interview with you of no longer than one-hour duration. This will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by you. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences you share in the interview will be compared with those of other participants, and common themes identified.

I will then return to the school for the student interview, on another date at a time and place convenient for you, your principal, the student and their parent/caregiver. On that day the purpose of the interview will be explained in simple language to the student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will proceed to conduct a short interview (approximately 15 minutes) with the student. Please note, it is a requirement that another adult (e.g. a teacher aide or another teacher) accompany the student for this interview with me, for student safety and so that the student may speak freely about their experience of

using the RM with you. When organising the date and time of the student interview, I will ask you to please confirm that you have organised a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following your interview, no further action will be required except organising a time and supervisor for the student interview.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public without your prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it electronically to rachel.barker@pg.canterbury.ac.nz or in hard copy to the child's RTD.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Teachers

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that parent/caregiver consent has already been obtained for the student interview.
- ☐ I understand that I am not obligated to participate even though parent/caregiver consent has been given for the student to.
- ☐ I understand that permission from my school principal is required for both teacher and student interviews, and that they will receive a similar information and consent document to sign for this purpose.
- ☐ I understand that I am required to organise a supervisor if a student interview is to take place.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.

☐ By signing below, I agree to participate in this research project.

Name:_____ School:_____

Signed:_____ Date:_____

Email address *(for report of findings, if applicable)*:

_____

Please sign and either send electronically to rachel.barker@pg.canterbury.ac.nz or return in hard copy to the child's RTD.

Appendix M

RTD Recruitment - Principal information letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Principals

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Canterbury who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been approached because a parent of one of your students has expressed an interest in their child participating in this research. They have been told about this study by the Resource Teacher of the Deaf (RTD) that works with their child. I am interested in interviewing both this student and their teacher, and would like to request your permission.

Although parent consent has been given, I would like to emphasize that you are not obligated to give permission for teacher and student interviews. The teacher in question is also not obligated to take part in the research.

If permission is granted, at a mutually agreed upon time, I will visit your school to conduct an interview with the teacher in question. This will take no longer than one hour to complete and will require an empty classroom. The discussion will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by the teacher. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences they share in the interview will be compared with those of other participants, and common themes identified.

I will then return to the school for the student interview on another date, at a time and place convenient for you, the teacher, the student and their parent/caregiver. On that day the purpose of the interview will be explained in simple language to the student by showing them an information slideshow, and they will say whether or not they agree to talk with me and indicate this on an assent form. If assent is given then I will

proceed to conduct a short interview (approximately 15 minutes) with the student. It is a requirement that another adult (e.g. a teacher aide or teacher, but not the student's teacher) be present for this interview to take place with me. This is so that the student may speak freely about their experience of using the RM with their teacher. When organising the date and time of the student interview, the teacher will be asked to confirm a suitable person for this role. This adult will be required to sign a confidentiality agreement before supervising the interview. The data will be treated in the same manner, as described above.

Following the teacher's interview, no further action will be required except organising the time and supervisor for the student interview. Following the student interview, no further action will be required.

To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher and all students interviewed will receive a sticker or small toy.

Teacher and student participation are voluntary, and they have the right to withdraw at any stage without penalty. You have the right to withdraw your permission for the teacher and/or student's participation at any stage without penalty. The teacher and/or student may ask for their raw data (audio file and transcript) to be returned to them or destroyed at any point. If you withdraw your permission, I will remove information relating to your teacher and/or student. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of the teacher's or student's data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about giving permission for teacher and/or student participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for the teacher and/or student to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or in hard copy to the child's RTD.

Rachel Elizabeth Barker

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Principals

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of the teacher if they agree to take part in the research.
- ☐ I understand what is required of the student if they agree to take part in the research.
- ☐ I understand that it is a requirement for all student interviews that a member of staff is present for the duration of the meeting (not the child's classroom teacher), and that the teacher will organise for a suitable person to be present.
- ☐ I understand that parent/caregiver consent has already been obtained for the student interview.
- ☐ I understand that I am not obligated to give permission, and the teacher is not obligated to participate, even though parent/caregiver consent has been given.

Please tick or delete as appropriate:

- ☐ I give permission for the **teacher** I employ, as named below, to take part in the research.
- ☐ I give permission for the **student** at my school, as named below, to take part in the research.

- ☐ I understand that teacher and student participation is voluntary, and I may withdraw either permission at any time without penalty. Withdrawal of permission will also include the withdrawal of any information that I, the teacher or the student have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I, the teacher, or the student provide will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

☐ I would like a summary of the results of the project.

Principal's Name: _____ School:_____

Email address *(for report of findings, if applicable)*:

_____

By signing below, **I give permission for my employee** _____(teacher's full name) to participate in this research project.

Signed:_____Date:_____

By signing below, **I give permission for my student** _____(student's full name) to participate in this research project, on the condition that student assent is obtained, and with the knowledge that parent/caregiver consent has already been obtained.

Signed:_____Date:_____

Please either sign and send electronically to rachel.barker@pg.canterbury.ac.nz, or return in hard-copy to the child's RTD.

Appendix N

RTD Recruitment - Parent/caregiver letter and consent form

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Parent/Caregiver

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Canterbury who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

You have been given this letter by the Resource Teacher of the Deaf (RTD) who works with your child because they think you might be interested in your child taking part. Permission to distribute this information to RTDs has been granted by Paul Peryman and Bernadette Mulcahy-Bouwman at Van Asch Deaf Education Centre.

Your child currently uses an RM system in their classroom. This device consists of a microphone worn by the teacher that transmits their voice directly to an earpiece worn by the child. It helps your child to hear their teacher's voice more clearly. With your permission, I would like interview your son/daughter and their teacher to ask them about their experiences of using their RM system.

If you grant permission for me to interview your child by signing the attached consent form, I will then contact their school principal and teacher to ask if they are interested in being involved with the study. They will also be given information sheets and asked to sign consent forms. Teacher and student interviews will only be organised if all parties consent.

If agreed upon, I will visit your child's school at a time and place convenient for you, their principal, and their teacher. On the day, the purpose of the interview will be explained in simple language to your child by showing them an information slideshow. They will say whether or not they agree to talk with me and will indicate this on an assent form. If they are happy to proceed, a short interview of approximately 15 minutes will commence. Your child will be accompanied by an adult for the duration of the meeting (e.g. a teacher other than their own, or a teacher aide). This adult will be arranged by your child's teacher and is required to sign a confidentiality agreement before supervising the interview.

The discussion with your child will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by your child. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences each student shares in their interview will be compared with those of other participants, and common themes identified.

In order to confirm your child's eligibility for this study, the researcher Rachel Barker may need to contact a member of the professional team working with your child e.g. their audiologist, Adviser on Deaf Children (AoDC), RTD (Resource Teacher of the Deaf), or Assist worker. By signing the attached consent form, and providing contact details, you give permission for Rachel to discuss your child's hearing needs and case history with any of these professionals, and to include this information in the study as needed.

To acknowledge their participation all students interviewed will receive a sticker or small toy.

Following the student interview, no further action will be required by the student or their parent/caregiver.

Participation is voluntary. You and your child have the right to withdraw at any stage without penalty. You may ask for your child's raw data (audio file and transcript) to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to your child. However, once analysis of raw data starts on 5th September 2019, it will become increasingly difficult to remove the influence of their data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Please indicate to me on the consent form if you would like to receive a copy of the summary of results of the project.
The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project. Please also feel free to discuss your child's participation in this study with their principal and/or classroom teacher if you wish.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to give permission for your child to participate in the study, you are asked to complete the consent form and return it either electronically to rachel.barker@pg.canterbury.ac.nz, or as a hard-copy to your child's RTD.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475
Email:
rachel.barker@pg.canterbury.ac.nz

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Consent Form for Parent/Caregiver

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of my child if I agree for them to take part in the research.
- ☐ **I am aware that if I give permission for my child to be involved, my child's school principal and teacher will then be contacted by Rachel Elizabeth Barker and asked if they are interested in taking part.**
- ☐ I am aware that interviews will only take place if consent is granted by all parties (a parent/caregiver, the principal, and the teacher), and if more participants are required for the study. This may mean that my child is not interviewed.
- ☐ I understand that other than giving this permission, there is no requirement for me to take any further action related to this research.
- ☐ I understand that my child will at all times be accompanied by a member of school staff, (to be organised by my child's teacher), and not left alone with the researcher Rachel Elizabeth Barker.
- ☐ I understand that student participation is voluntary and I may withdraw my permission at any time without penalty. Withdrawal of participation will also include the withdrawal of any information my child has provided should this remain practically achievable.
- ☐ I understand that the researcher Rachel Barker may need to contact members of the professional team working with my child e.g. their audiologist, AoDC (Adviser on Deaf Children), RTD (Resource Teacher of the Deaf), or Assist worker. I give permission for this contact, for Rachel to discuss my child's hearing needs and case history with them, and for this information to be included in the study as necessary.
- ☐ I understand that any information or opinions my child provides will be kept confidential to the researcher Rachel Elizabeth Barker and supervisors Dean Sutherland and Paul Peryman, and that any published or reported results will not identify the participants or their school. I understand that a thesis is a public document and will be available through the UC Library in hard-copy and online.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years.
- ☐ I understand that I can contact the researcher Rachel Elizabeth Barker (rachel.barker@pg.canterbury.ac.nz) or supervisors Dean Sutherland (dean.sutherland@canterbury.ac.nz) and Paul Peryman (paul.peryman@deafeducation.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I give permission for my child to participate in this research project, on the condition that they themselves agree to talk with the researcher Rachel Elizabeth Barker.

Parent/Caregiver Name: _____ Child's Name: _____

Child's School: _____

If known, names of hearing professionals that work with my child e.g. Audiologist (at Triton Hearing), AoDC, RTD etc.:

_____

_____

Parent/Caregiver Signature: _____ Date: _____

Email address *(for report of findings, if applicable)*:

_____

Parent/caregiver, please sign and either send electronically to rachel.barker@pg.canterbury.ac.nz, or return in hard copy to your child's RTD.

No further action is needed.

Appendix O

(All Groups) – Interview supervisor letter and confidentiality form

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019
Ref: 2019/27/ERHEC

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Information Sheet for Interview Supervisors

My name is Rachel Elizabeth Barker, and I am a second year Master of Audiology student at the University of Canterbury, New Zealand. I am currently undertaking a research project that involves interviewing teachers and students in Christchurch who use a remote microphone (RM) system in their classroom. The aim of this research is to record experiences, identify barriers to optimal RM use, and to make recommendations for future users.

A child in your school currently uses an RM system in their classroom. This device consists of a microphone worn by the teacher that transmits their voice directly to an earpiece worn by the child. It helps the child to hear their teacher's voice more clearly. I will be interviewing this child to ask them about their experiences of using their RM system.

It is a requirement of this research that an adult (not the student's teacher) be present for the duration of the student interview. You have been approached with the request that you fill this role. There are two requirements for an interview supervisor. Firstly, they must remain present for the entirety of the student interview to ensure the student's safety and comfort. Secondly, they must keep all data, information and opinions confidential and ensure that this information is not divulged in conversations with any other persons, including the student's parents, teacher(s), and other colleagues.

The details below have been supplied to the principal and parents of the student, and are shown here for your information:

On the day, the purpose of the interview will be explained in simple language to the child by showing them an information slideshow. They will say whether or not they agree to talk with me and will indicate this on an assent form. If they are happy to proceed, a short interview of approximately 15 minutes will commence.

The discussion with the child will be semi-structured, meaning that a selection of pre-determined questions will be asked, but with the flexibility to also discuss issues raised by the child. The conversation will be audio recorded using a primary and backup device. Immediately after interview (or as soon as practically possible) the files will be uploaded to secure storage on the university server. The original files will then be deleted from the recording devices. The conversation will later be transcribed by me using an assigned pseudonym. This pseudonym will be used in all reporting. The experiences each student shares in their interview will be compared with those of other participants, and common themes identified.

To acknowledge their participation all students interviewed will receive a sticker or small toy.

Following the student interview, no further action will be required by the student, their parents or the interview supervisor.

Participation is voluntary. Teachers, parents and children have the right to withdraw at any stage without penalty. Participants may ask for their raw data (audio file and transcript) to be returned or destroyed at any point. If they withdraw, I will remove information relating to them. However, once analysis of raw data starts on 5th August 2019, it will become increasingly difficult to remove the influence of their data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: identities will not be made public without prior consent. To ensure confidentiality, participants will be identified only by pseudonym. Access to data will be restricted to the primary researcher (Rachel Elizabeth Barker) and supervisors (Dean Sutherland and Paul Peryman). Files will be stored securely as password protected files on a password protected computer. Data will be backed up on University of Canterbury servers. All data will be destroyed after a period of five years as per the University of Canterbury research data protocols and recommendations set forth by the University of Canterbury Human Ethics Committee. A thesis is a public document and will be available through the UC Library in hard copy and through the online thesis repository. In addition, the findings may be written up and submitted for peer-review in a scholarly journal or presented orally or via poster at a professional conference.

Participants will indicate to me on the consent form if they would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee, and participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to take on the role of interview supervisor, you are asked to complete the confidentiality form and return it to the researcher prior to the child's interview.

Rachel Elizabeth Barker

Department of Communication Disorders
Telephone: 022 0942475

rachel.barker@pg.canterbury.ac.nz

23/04/2019

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms

Interview Supervisor Confidentiality Form

I have been given a full explanation of this project and have been given an opportunity to ask questions.

I have discussed the research protocols with the researcher Rachel Elizabeth Barker, and I understand what will be required of me as an interview supervisor on this project.

I understand that I am required to be present for the duration of the student interview, to ensure that student's safety and comfort.

I understand that all data, information or opinions provided to me must be kept confidential and that I must ensure that this information is not divulged in conversations with any other persons, including the student's parents, teacher(s), and other colleagues.

I understand that if I require further information or advice related to this confidentiality agreement that I can contact the primary researcher, Rachel Elizabeth Barker, at the email address above. If I have any complaints, I can contact the Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

By signing below, I agree to abide by the confidentiality requirements specified in this agreement:

Your name .....

Name of student to be supervised .....

Date.....

Signature .....

Email address .....

Please complete this form and return to the researcher Rachel Elizabeth Barker prior to the beginning of the student interview.

Appendix P

Student Information Powerpoint

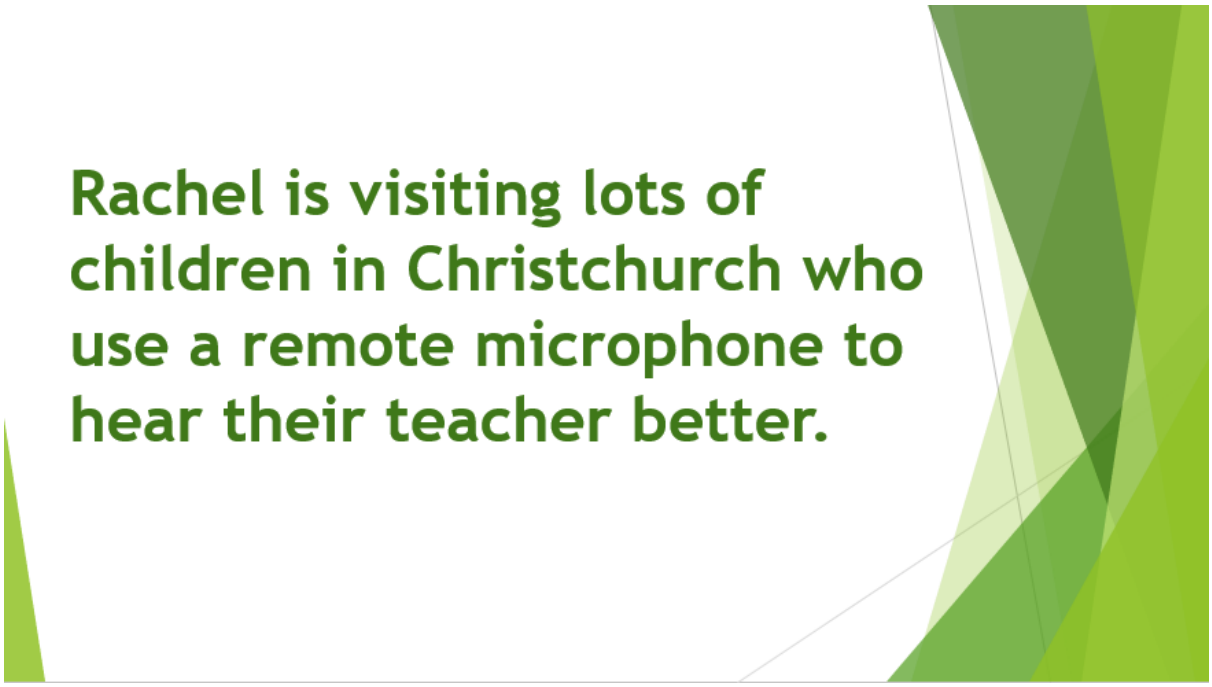
Student Information Slide Show

Study Title: Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms.

Researcher: Rachel Elizabeth Barker, MAud student, University of Canterbury.

This is Rachel.

She is learning how to help children hear their teacher better at school.


Rachel is visiting lots of children in Christchurch who use a remote microphone to hear their teacher better.


Rachel is visiting me today to see if I would like to help her learn, by answering some questions about my remote microphone.

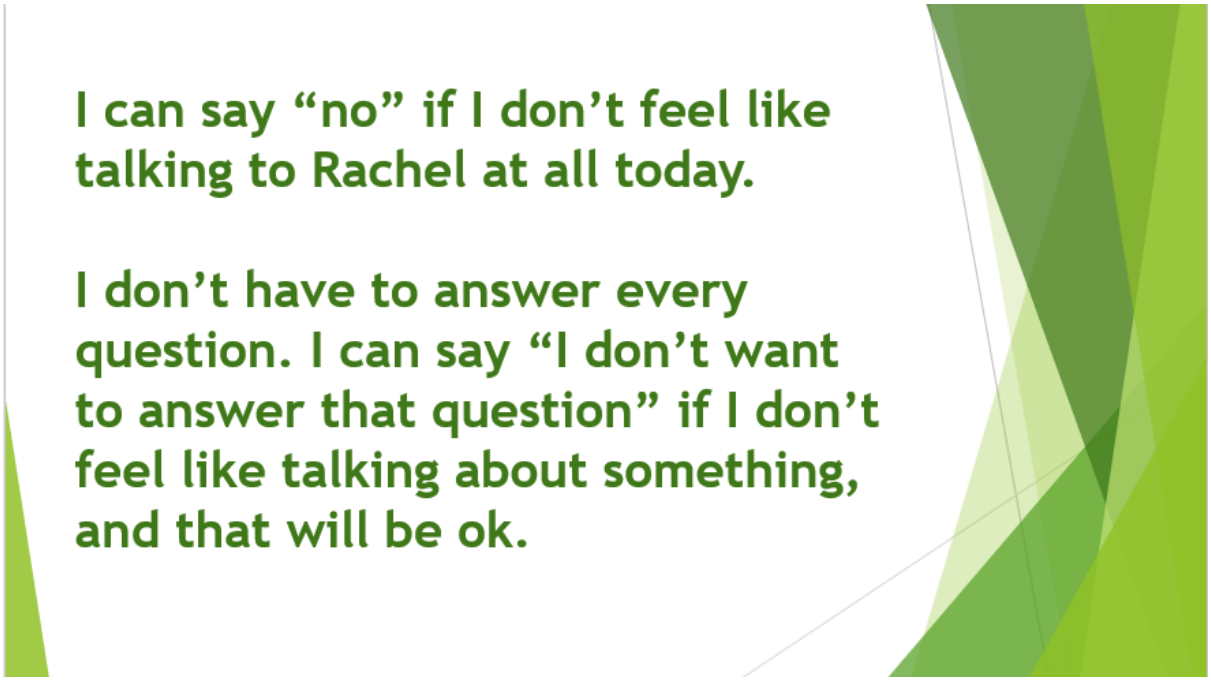
Some of the questions Rachel might ask are:

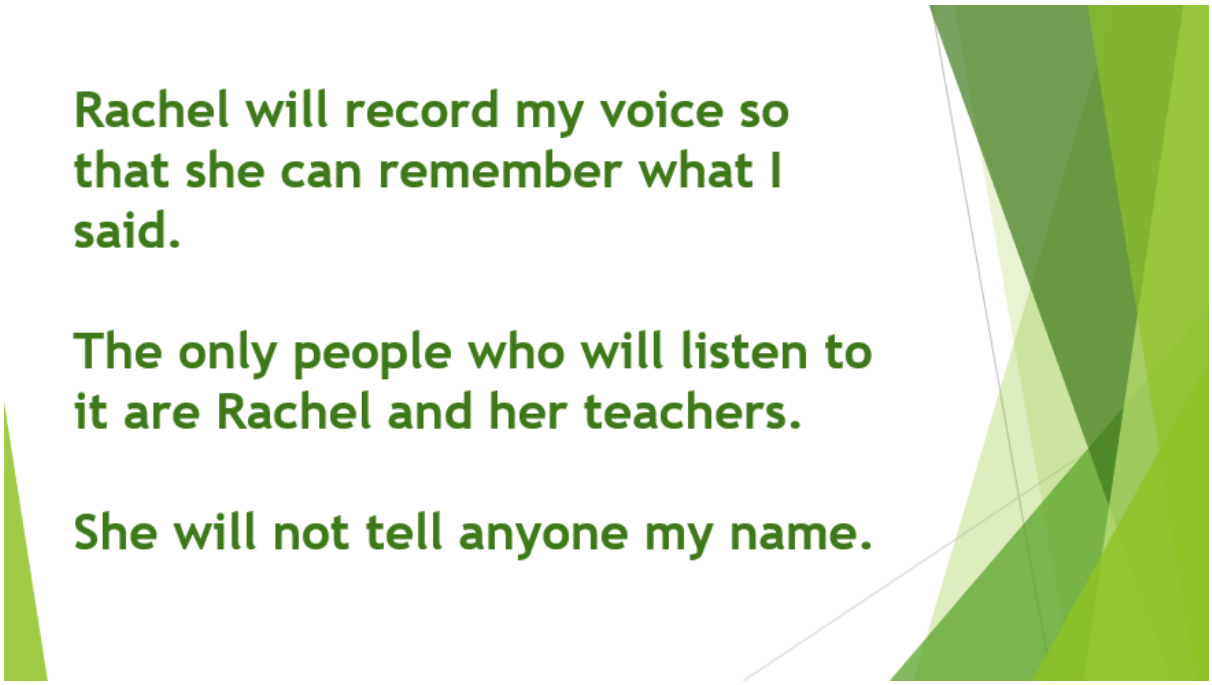
"When does your remote microphone help you to hear better?"

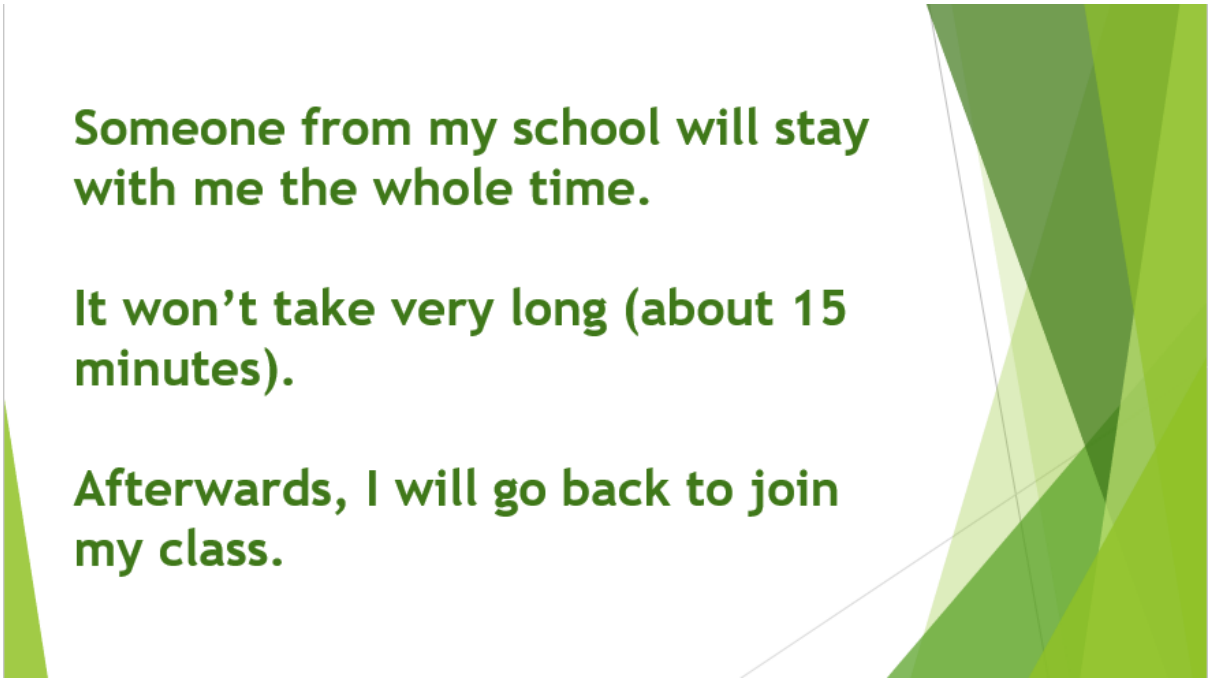
and

"What does your teacher do to help you use your remote microphone?"

Rachel is interested to know the good and the bad parts about using one.

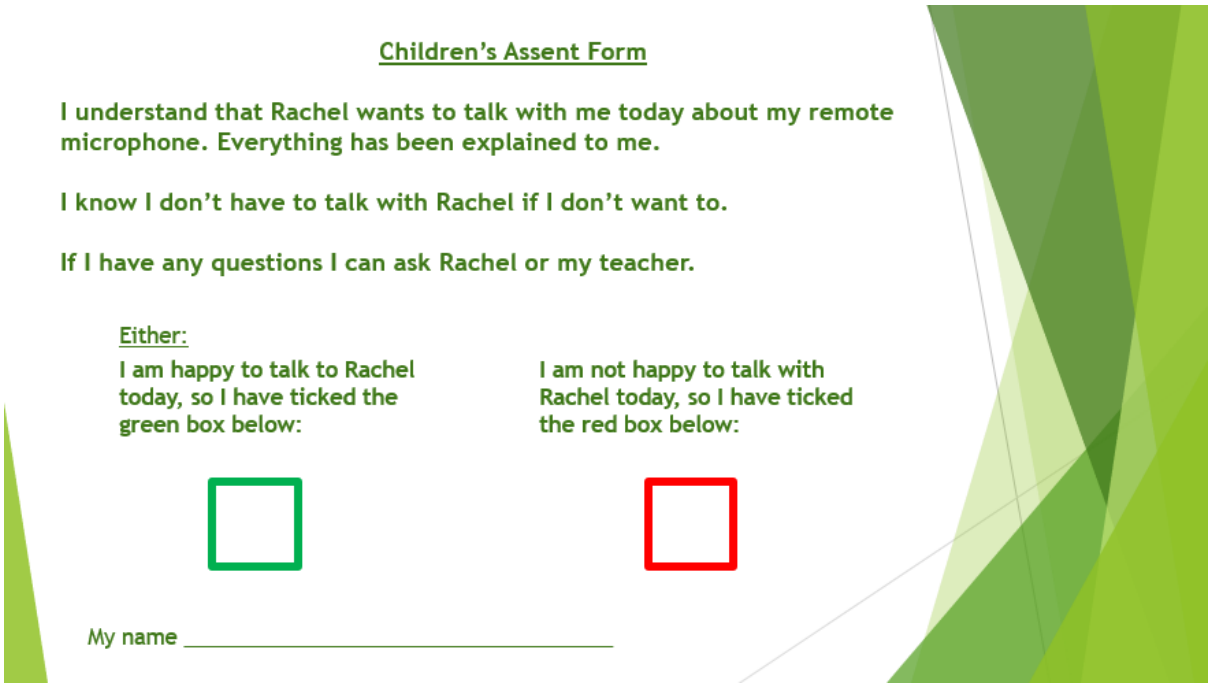

I can say “no” if I don’t feel like talking to Rachel at all today.
I don’t have to answer every question. I can say “I don’t want to answer that question” if I don’t feel like talking about something, and that will be ok.


Rachel will record my voice so that she can remember what I said.
The only people who will listen to it are Rachel and her teachers.
She will not tell anyone my name.


Someone from my school will stay with me the whole time.
It won't take very long (about 15 minutes).
Afterwards, I will go back to join my class.

Appendix Q

Student Assent Form, Tick Box Version



Appendix R

Student Assent Form, Smiley Face Version

Children's Assent Form

I understand that Rachel wants to talk with me today about my remote microphone. Everything has been explained to me.

I know I don't have to talk with Rachel if I don't want to.

If I have any questions I can ask Rachel or my teacher.

Either:

I am happy to talk to Rachel today, so I have coloured in the smiley face.

I am not happy to talk with Rachel today, so I have coloured in the sad face.

My name _____

Appendix S

Facebook Advert for Teachers

Rachel Barker
20 June

Post approved by Amber

Are you a Christchurch teacher who wears a microphone while teaching?

If so, please keep reading…

Hello! My name is Rachel and I'm a teacher who is retraining in audiology (hearing and balance). For my Master of Audiology degree at the University of Canterbury, I'm currently writing a thesis on the topic of 'Teacher and Student Experiences of Remote Microphone Systems in New Zealand Primary School Classrooms'.

I'm looking for participants who would be willing to be interviewed about their experiences. To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher.

In order to be eligible, participants need to be:

a) Currently using a remote microphone system (for children with e.g. hearing loss or auditory processing disorder etc.)
b) Teaching in Christchurch.
c) Teaching in a primary school classroom.

If you qualify, I'd be grateful to make contact. Please email me at rachel.barker@pg.canterbury.ac.nz to register your interest and receive an information pack for you and your principal. By registering interest, you are not committed to taking part.

Thank you for your consideration.

The project is being carried out as a requirement for the MAud (Master of Audiology) degree by Rachel Elizabeth Barker under the supervision of Dean Sutherland and Paul Peryman who can be contacted at: dean.sutherland@canterbury.ac.nz; paul.peryman@deafeducation.nz

This advertisement has full approval from the University of Canterbury Educational Research Human Ethics Committee. Participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

Appendix T

Email to AoDCs

To whom it may concern,

My name is Rachel Elizabeth Barker and I'm a Master of Audiology student at the University of Canterbury. I am contacting you with permission from Paul Peryman and Bernadette Mulcahy-Bouwman at Van Asch Deaf Education Centre. Paul is my secondary project supervisor, and I am working under the guidance of my primary supervisor Dean Sutherland, senior lecturer in Communication Disorders at UC.

I am currently writing a thesis on the topic of 'Teacher and Student Experiences of Remote Microphones in New Zealand Primary School Classrooms'. This project involves interviewing teachers and students, and I am currently looking for participants.

In order to be eligible, participants must be:

1) A current user of a remote microphone system in their classroom

2) Teaching in Christchurch

3) Teaching in a primary school classroom

I have attached information sheets for teachers and principals to this email, please feel free to have a read yourself. I would be grateful if you could pass these on to teachers you work with that might be interested in taking part. To acknowledge their participation, all teachers interviewed will receive a $20 supermarket voucher. Please feel free to email me at rachel.barker@pg.canterbury.ac.nz if you have any questions or concerns.

This research has full approval from the University of Canterbury Educational Research Human Ethics Committee. Participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

Yours sincerely,

Rachel Elizabeth Barker.